BULL. BOT. SURV. INDIA
Vol. 27, Nos. 1-4: pp. 1-28, 1985

LEGUMINOSAE-PAPILIONOIDEAE : TRIBE — PHASEOLEAE

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ABSTRACT

Phaseoleae is a big tribe under Leguminosae and the authors are presenting a revision dealing with 4 genera under *Dysolobium*-3 species, *Macroptilium*-2 species, *Vigna*-19 species and *Phaseolus*-23 species, excluding some varieties discussed in this paper. Some doubtful species like *Vigna repens*, *Phaseolus tenuicaulis* and *Voandzeia subterranea* have been left out after giving their taxonomic citations.

Phaseoleae Hutch. Gen. Fl. Pl. 1 : 434. 1964. Phaseoleae subtribe Euphaseoleae Benth. & Hook. f. Gen. Pl. 1 : 453. 1865 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 59. 1876.

Erect, creeping or climbing herbs, often woody at base. Leaves pinnately 3-foliolate, rarely 1- or 5-7-foliolate ; leaflets entire or lobed ; stipels mostly present. Inflorescence usually tubercled (with swollen nodes). Bracts small, usually caducous. Corolla papilionaceous ; keel long-beaked or spirally twisted. Stamens diadelphous ; vexillary filament usually free or often partly connate with the others into a sheath split adaxially ; anthers uniform. Ovary many-ovuled ; style bearded lengthwise on the innerside or pilose only around the stigma. Pod 2-valved, partitioned or not between the seeds, not jointed. Seeds strophiolate or not.

Type genus : *Phaseolus* Linn.

Distribution : About 25-30 genera with over 500 species ; chiefly distributed in tropics. In India there are about 11-13 genera with over 55 species.

Generic delimitation of *Phaseolus* Linn., *Macroptilium* (Benth.) Urb., *Vigna* Savi and *Dysolobium* (Benth.) Prain :

Baker (in Hook. f. Fl. Brit. Ind. 2 : 200, 204. 1876) recognized 15 species of *Phaseolus*, and 10 of *Vigna* for British India. He distributed 15 species of *Phaseolus* among 4 subgenera—*Phaseolus* proper, *Macroptilium, Strophostyles* and *Dysolobium*, whereas the species of *Vigna* were included among 2 subgenera—*Vigna* and Subg. *Plectrotropis.* The authors of Regional Floras (Cooke, Duthie, Gamble and Haines) more or less adopted Baker's generic concepts. Prain (J. Asiat. Soc. Beng. 66 : 425. 1897) recognized *Dysolobium* as a distinct genus, whereas Urban (Symb. Antill. 9 : 457. 1928) recognized *Macroptilium* as distinct from both *Vigna* and *Phaseolus.* With the recognition of both *Dysolobium* and *Macroptilium,* the Indian species of *Phaseolus* and *Vigna* are segregated among 4 genera.

Wilczek (Fl. Congo Belge et Ruanda-Urundi 6 : 261. 1954) redefined the generic limits of both *Phaseolus* and *Vigna* as outlined by Bentham and Hooker f. (Gen. Pl. 1 : 538. 1865) because certain old world species, which were placed under *Phaseolus,* are more closely allied to *Vigna* rather than

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Date of receipt : 11.2.85. Date of acceptance: 23.4.86

to *Phaseolus*. He distinguished *Phaseolus* and *Vigna* in the following way :

1a. Stipules not prolonged below the point of attachment. Keel in a spiral of 1-5 complete turns. Stigma elongated, internal or sometimes very short, terminal or subterminal. Style without a beak .. *Phaseolus*

1b. Stipules prolonged below the point of attachment. Keel straight to incurved, rarely making almost 1 complete spiral turn. Style prolonged beyond the stigma in more or less distinct beak .. *Vigna*

According to Wilczek's generic circumscription of *Phaseolus* and *Vigna*, the genus *Phaseolus* is strictly of New World in distribution, whereas the African and Asian species, which were hitherto treated under *Phaseolus*, belong to *Vigna*. Ohwi (Fl. Jap. 690. 1953) recognized the genus *Azukia* for those Asian species of *Phaseolus* (*P. angularis*, *P. calcaratus*, *P. radiatus* and *P. aureus*) which have peltate stipules and characteristic keel, style and pollen. Maekawa (Jap. J. Bot. 15 : 114. 1955) separated *P. aureus* and *P. mungo* from *Azukia* into another new genus *Rudua* on the basis that their first foliage leaves are sessile in contrast to petiolate leaves of *Azukia*.

While dealing with the tropical East African members of *Vigna*, Verdcourt (Kew Bull. 24 : 507. 1970) discussed the generic circumscription of *Phaseolus*, *Vigna* and its related genera at length. He adopted Wilczek's generic concepts of *Phaseolus* and *Vigna*, and recognized *Strophostyles* and *Macroptilium* as distinct genera. Further, he divided the genus *Vigna* into 8 subgenera—*Vigna*, *Sigmoidotropis*, *Cochliasanthus*, *Plectrotropis*, *Ceratotropis*, *Dolichovigna*, *Macrorhynchus* and *Haydonia*. Maréchal *et al.* (Boissiera 22 : 236. 1978) followed a similar generic circumscription for *Phaseolus-Vigna* group, with *Dysolobium* as a distinct genus.

We have followed Verdcourt, and as well as Maréchal *et al.* in recognizing *Phaseolus*, *Vigna*, *Macroptilium* and *Dysolobium* as distinct taxa, although there are certain intermediates which connect these taxa to one another.

KEY TO *PHASEOLUS*, *MACROPTILIUM*, *VIGNA* AND *DYSOLOBIUM*

1a. Pods thick, woody. Seeds hairy. Wings shorter than keel. Plants woody twiners .. 1. *Dysolobium*

1b. Pods slender, not woody. Seeds glabrous. Wings as long as the keel. Plants mostly herbaceous twiners :

  2a. Stipules mostly produced below the point of attachment. Keel straight or incurved, rarely making almost one complete spiral turn or 5-7 turns .. 4. *Vigna*

  2b. Stipules not produced below the point of attachment. Keel in a spiral of 1-5 complete turns :

    3a. Standard not auriculate at base .. 3. *Phaseolus*

    3b. Standard auriculate at base 2. *Macroptilium*

1. Dysolobium

(Benth.) Prain in J. Asiat. Soc. Beng. 66 : 425. 1897 ; Hutchinson, Gen. Fl. Pl. 1 : 443. 1964 ; Maréchal *et al.* in Boissiera 28 : 236. 1978 ; *Phaseolus* L. Sect. *Dysolobium* Benth. Pl. Jungh. 239. 1852. *Phaseolus* L. subgen. *Dysolobium* (Benth.) Baker in Hook. f. Fl. Brit. Ind. 2 : 204. 1876.

Woody twiners. Stems usually clothed with brownish hairs or glabrescent. Leaves 3-foliolate. Stipules basifixed, deciduous, usually small. Racemes axillary, long-peduncled, many-flowered, tuberculate. Bracteoles inconspicuous, deciduous. Calyx campanulate, 2 upper teeth connate into a bidentate upper lip, lowermost tooth longest. Corolla much-exserted ; standard with 2 inflexed, basal auricles ; wings shorter than the keel ; keel with a curved hard beak, laterally deflexed. Stamens diadelphous ; anthers uniform. Ovary sessile, hairy, 4-α-ovuled ; style filiform, bearded below the stigma. Pods sessile, thick, woody, subterete, densely patently hairy, very markedly septate between the seeds, endocarp, papery, easily separating, forming compartment around seeds. Seeds 4-α, exalbuminous, hairy.

Type species : *D. dolichoides* (Roxb.) Prain

Distribution : 4-5 species in tropical Eastern Himalaya to China and Malaysia. 4 species occur in India.

1 a. Pod prominently winged along angles .. 4. *D. tetragonum*
b Pod only keeled along sutures :
2a. Flowers not exceeding 1 cm long. Racemes on 2-10 cm long peduncles. Beak of keel not deflexed .. 1. *D. dolichoides*
2b. Flowers exceeding 1 cm long. Racemes on more than 10 cm long peduncles. Beak of keel deflexed or not deflexed :
3a. Leaflets hirsute, coriaceous, rounded-cuspidate at apex. Style bearded down the face. Beak of keel deflexed .. 2. *D. grande*
3b. Leaflets glabrous, membranous, narrowed into an acute point. Style penicillate round the stigma. Beak of keel not deflexed .. 3. *D. lucens*

1. Dysolobium dolichoides (Roxb.) Prain in J. Asiat. Soc. Beng. 66 : 425. 1897 ; Maréchal *et al.* in Boissiera 28 : 237. 1978 ; *Phaseolus dolichoides* Roxb. Fl. Ind. 3 : 290. 1832 ; Benth. in Miq. Pl. Jungh. 239. 1852. *Canavalia dolichoides* (Roxb.) Kurz in J. Asiat. Soc. Beng. 44 : 185. 1876. *Vigna dolichoides* (Roxb.) Baker in Fl. Brit. Ind. 2 : 206. 1876.

Stout twiners. Stems, petioles and peduncles densely villous with reflexed, brown hairs. Leaflets ovate, ovate-rhomboid or oblong-lanceolate, obtuse and mucronate, appressed-pubescent, 4-17 × 3-16 cm. Stipules minute, lanceolate. Racemes 20-24-tubercled on 2-10 cm long peduncles. Flowers on 0.2 cm long pedicels. Calyx hairy. Standard greenish outside with violet blotches and streaks on the innerside, 0.9-1 cm across. Pods oblong, densely patently brown-hairy, sutures keeled, 3-7 cm long ; seeds 4-10 per pod, separated by septa. Seeds black, minutely appressedly hairy.

Lectotype : Roxburgh's Icones (ined.) 1809 (CAL).

Fls. : Sept.-Oct. *Frts.* : Nov.-Dec.

Distribution : INDIA : Eastern Himalayas and Western Ghats : Assam and Tamil Nadu ; JAVA, BANGLADESH, VIETNAM, KAMPUCHEA.

Ecology : A rainforest species.

Notes : Closely allied to *D. grande* but differs from it in having shorter peduncles and smaller flowers.

2. D. grande (Buch.-Ham. ex Benth.) Prain in J. Asiat. Soc. Beng. 66 : 427. 1897 ; Maréchal *et al.* in Boissiera 28 : 239. 1978 ; *Phaseolus grandis* Buch.-Ham. ex Benth. in Miq. Pl. Jungh. 1 : 239. 1852. *P. velutinus* Grah. ex Baker in Hook. f. Fl. Brit. Ind. 2 : 204. 1876 ; *Canavalia grandis* (Buch.-Ham.) Kurz in J. Asiat. Soc. Beng. 43 : 185. 1874.

Woody twiners. Stems glabrous to villous. Leaflets 17 × 12 cm, lateral ones ovate-deltoid, acuminate, subtruncate-rounded at base, hairy along the veins, terminal one ovate with a cuneate base. Petioles appressedly woolly with creamish hairs, 5-12 cm long. Stipules lanceolate, acuminate. Racemes many-tubercled, on 60 cm long peduncles. Flowers on 1 cm long pedicels. Bracts ovate, obtuse, 0.3 cm long. Calyx villous, lobes obtuse, 0.1-0.2 cm long. Corolla showy, 2.5-3 cm long. Pods oblong, beaked, villous with brownish hairs, sutures keeled, 12 × 2 cm. Seeds rounded, hairy, 1.2 × 0.8 cm.

Type : Nepal : Guyalpara, 23 Oct. 1808, *Hamilton* in *Wallich* num. List. No. 5602A (CAL-isolectotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : A rainforest species.

Chr. No. : 2n=22 (Bir and Kumari in *Taxon* 27 : 53-61. 1978).

Distribution: INDIA: Tropical Eastern Himalayas (up to 1500 m), Assam, Meghalaya ; BANGLADESH, BURMA, NEPAL, THAILAND.

3. D. lucens (Wall. ex Benth.) Prain in J. Asiat. Soc. Beng. 66 : 427. 1897. *Phaseo-*

lus lucens Wall. ex Benth. in Miq. Pl. Jungh. 1 : 239. 1852 (in obs.). *Canavalia lucens* (Wall. ex Benth.) Kurz in J. Asiat. Soc. Beng. 43 : 185. 1874 et 45 : 252. 1876. *Vigna lucens* (Wall. ex Benth.) Baker in Hook. f. Fl. Brit. Ind. 2 : 207. 1876.

Twining perennials. Stems, petioles and peduncles sparsely hairy with greyish hairs. Leaflets membranous, deltoid, rounded at base, glabrous, up to 8.5 cm long. Stipules lanceolate, caducous, 0.3 × 0.1 cm. Racemes on ± 8 cm long peduncles. Flowers reddish. Calyx nearly glabrous. Corolla up to 0.8 cm long. Pods beaked, hairy with short yellowish-brown hairs, many-seeded.

Type : Burma : Tavoy, W. Gomez, *Wallich* num. List. No. 5601 (CAL-isotype).

Fls. : July-Aug. *Frts.* : Oct.-Nov.

Ecology : A rainforest species.

Distribution : INDIA : Eastern Himalayas, Arunachal Pradesh, Assam ; BANGLADESH, BURMA.

Notes : Closely allied to *D. grande,* but *D. lucens* differs from it in having glabrous leaflets and calyx ; also distinguishable from *D. dolichoides* and *D. tetragonum* by pods being not keeled, nor winged along sutures.

4. Dysolobium tetragonum Prain in J. Asiat. Soc. Beng. 66 : 427. 1897. *Psophocarpus* sp. Baker in Hook. f. Fl. Brit. Ind. 2 : 212. 1876. (in Obs.)

Woody twiners. Stems, petioles and peduncles clothed with rusty-brown hairs. Leaflets narrowly lanceolate-ovate, acute to shortly acuminate, subtruncate at base, appressedly hairy on both surfaces. Racemes 12-16-tubercled, on 3.5-4 cm long peduncles. Pods distinctly winged, densely pubescent with rusty-brown hairs, 4.5 × 0.4-0.5 cm.

Type : India : Assam, *Masters* 829 (K-lectotype ; CAL-isolectotype).

Fls. : September.

Ecology : A rainforest species.

Distribution : INDIA : Eastern Himalaya, Assam ; endemic.

Notes : A remarkable species that can be recognized at once from all other species of the genus by its winged fruits—a character of *Psophocarpus.*

2. MACROPTILIUM

(Benth.) Urb. Symb. Antill. 9 : 457. 1928 ; Hutchinson, Gen. Fl. Pl. 1 : 437. 1964 ; Maréchal *et al.* in Boissiera 28 : 151. 1978 ; *Phaseolus* L. Sect. *Macroptilium* Benth. Comm. Leg. Gen. 72. 1837. *Phaseolus* L. subgen. *Macroptilium* (Benth.) Baker in Hook. f. Fl. Brit. Ind. 2 : 201. 1876.

Twining or erect or suberect herbs. Leaves 3-foliolate or rarely 1-foliolate. Stipules not produced below the point of attachment. Racemes axillary, tubercled, peduncled. Flowers usually in pairs. Bracteoles caducous. Calyx-tube narrowly campanulate or subtubular, lobes free. Standard reflexed above, with 2 reflexed auricles at the base of limb ; wings longer than standard, long-clawed ; keel petals twisted, with subhooded apex. Stamens diadelphous ; anthers uniform. Ovary sessile, few- or many-ovuled ; style involute and thickened in the upper part, bearded inside below the apex ; stigma capitate, located a little towards inside. Pods subterete or compressed, straight or falcate. Seeds glabrous.

Type species : *M. lathyroides* (L.) Urb.

Distribution : 8 species in tropical America ; 2 species occur in India, one naturalized and the other cultivated in gardens.

1a. Suberect herbs. Leaflets acute. Stem fistular. Seeds 0.3×0.2 cm .. 2. *M. lathyroides*
1b. Twining herbs. Leaflets acuminate. Stem not fistular. Seeds 0.5×0.3 cm .. 1. *M. atropurpureum*

1. Macroptilium atropurpureum (DC.) Urb. Symb. Antill. 9 : 457. 1928. *Phaseolus atropurpureus* DC. Prodr. 2 : 395. 1825.

Twining, hairy herbs. Leaflets ovate-lanceolate, acuminate, 5 × 2.5 cm, lateral ones lobed. Petioles 2-3 cm long. Racemes long-peduncled, many-flowered. Pods appressedly hairy, 10 cm long. Seeds black, 0.6 × 0.3 cm.

Type : Not examined by the authors.

Chr. No. : 2n=22 (Sarbhoy in *Cytologia* 42 : 401-413. 1977).

Distribution : Native of S. America (Ecuador, Peru) ; rarely cultivated in gardens of India, particularly in Delhi State.

2. Macroptilium lathyroides (L.) Urb. Symb. Antill. 9 : 457. 1928. var. **lathyroides**; Maréchal *et al.* in Boissiera 28 : 151. 1978 ; *Phaseolus lathyroides* L. Sp. Pl. ed. 2. 1018. 1763. *P. psoraleoides* Wt. et Arn. Prodr. 244. 1834.

Branches twining at the top, somewhat stout, clothed with deciduous hairs. Leaflets elliptic or ovate-oblong, entire, acute, silky-hairy, 2-6 × 1-3 cm. Petioles up to 3 cm long. Stipules lanceolate, very acute, 0.5-1 cm long. Racemes on 10-40 cm long (including peduncle), with 3-35 cm long flower-bearing rachis, 3-25-tubercled. Flowers in pairs, on 0.1-0.15 cm long pedicels. Bracteoles narrowly lanceolate-subulate, caducous. Calyx hairy, tube 0.5 cm long, lobes 0.15 cm long. Corolla purple or brownish red, 1.8 cm long. Pods deflexed, 7-12 × 0.3-0.5 cm. Seeds 15-22 per pod, ecarunculate, black, compressed, 0.3 × 0.2 cm.

Type : Not examined by the authors.

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : Found along roadsides and waste places.

Chr. No. : 2n=22 (Singh & Roy in *Nucleus* 13 : 41-54. 1970).

Distribution : Native of America ; introduced and naturalized in Western Ghats, Karnataka and Tamilnadu ; SRILANKA, MALAYSIA.

var. **semierectum** (L.) Urb. Symb. Antill. 9 : 457. 1928 ; Maréchal *et al.* in Boissiera 28 : 152. 1978. *Phaseolus semierectus* L. Mant. 1 : 100. 1767.

Type : *Linnaeus* 899. 3 (LINN-holotype).

Suberect herbs. Similar to var. *lathyroides* in all other characters.

Ecology : Disturbed habitats.

Chr. No. : 2n=22 (Sarbhoy in *Cytologia* 42 : 401-413. 1977).

Distribution : Native of America ; introduced and natufalized in Western Ghats ; BRAZIL, CUBA, HAWAI, JAVA, PARAGUAY, PHILIPPINES, THAILAND, VIETNAM.

3. PHASEOLUS

L. Sp. Pl. 723. 1753. et Gen. Pl. ed. 5. 1754 *pro parte* ; Benth. Comm. Leg. Gen. 72. 1837 *pro parte* ; Benth. & Hook. f. Gen. Pl. 1 : 453. 1865 *pro parte* ; Hutchinson, Gen. Fl. Pl. 1 : 436. 1964 ; Verdc. in Kew Bull. 24 : 507. 1970 ; Maréchal *et al.* in Boissiera 28 : 133. 1978 ; *Phaseolus* L. subgen. *Phaseolus* proper Baker in Hook. f. Fl. Brit. Ind. 2 : 200. 1876. *Phaseolus auctt. mult. pro parte* ; Prain in J. Asiat. Soc. Beng. 66 : 421. 1898 ; Gamble, Fl. Pres. Madr. 1 : 361. 1918 (Repr. ed. 1 : 255. 1957) ; Cooke, Fl. Pres. Bomb. 4 : 378. 1902 (Repr. ed. 1 : 399. 1958) ; Haines, Bot. B'h. Or. 1 : 286. 1925 (Repr. ed. 1 : 299. 1961).

Erect, suberect or twining herbs. Leaves pinnately 3-foliolate or rarely 1-foliolate. Stipules not produced below the point of attachment (basifixed), persistent. Racemes axillary, short-peduncled, tuberculate or not. Bracteoles usually persistent for sometime. Calyx campanulate, upper lobes connate or free. Corolla white, yellow, red, violet or purple ; standard orbicular, recurved-spreading or subtwisted, non-appendiculate, margins inflexed at base ; wings as

long as or longer than standard ; keels with spirally twisted beak. Stamens diadelphous ; anthers uniform. Ovary subsessile, many-ovuled ; style thickened in the upper part, the thickened part together with the keel twisted through more than 360° or rarely much-reduced and not twisted ; stigma oblique. Pods compressed. Seeds estrophiolate.

Type species : *P. vulgaris* L.

Distribution : A few species native to S. America ; most of them are cultivated in warmer regions of both hemispheres ; 4 species occur in India, of which 3 are cultivated widely in hilly areas, and 1 is cultivated in agri-horticultural gardens.

1a. Pods finely pubescent .. 1. *P. acutifolius*
1b. Pods not hairy :
  2a. Flowers 1-2 pairs per raceme. Pods faintly tubercled. Peduncle of racemes up to 6 cm long. Vexillar stamen appendiculate at base .. 4. *P. vulgaris*
  2b. Flowers more than 2 pairs per raceme. Pods not tuberculate uniformly throughout. Vexillar stamen appendiculate or not at base :
    3a. Limb of standard densely short-hairy on the back. Racemes 2-4-flowered. Vexillar stamen exappendiculate .. 3. *P. lunatus*
    3b. Limb of standard glabrous on the back. Racemes 6-10-flowered. Vexillar stamen appendiculate at base .. 2. *P. coccineus*

1. Phaseolus acutifolius A. Gray, Pl. Wright. 1 : 43. 1852 ; Bailey, Man. Cult. Pl. ed. 2. 574. 1949 ; Maréchal *et al.* in Boissiera 28 : 140. 1978 ; Kay, Food Leg. 371. 1979.

Tepary bean, Rice haricot bean (Eng.) ; *Texan bean* (USA).

Suberect or twining, annual herbs, often bushy, glabrous or sparingly hairy. Leaflets ovate-lanceolate, acute, entire, 5 × 4 cm. Petiole 2-10 cm long. Flowers white, pink or pale-lilac, 1.5 cm long. Bracteoles deciduous. Pods straight or slightly curved, hairy, beaked, 5-9 × 1.2 cm, seeds 5-7 per pod. Seeds roundish to oblong, white, yellow, brown or bluish-black.

Fls. & Frts. : Oct.-Nov.

Type : New Mexico : *C. Wright, s. n.* (GH-holotype).

Chr. No. : 2n=22 (Sarbhoy in *Cytologia* 42 : 401-413. 1977).

Distribution : Native of Arizona and N.W. Mexico ; cultivated in Agri-horticultural gardens of the Indian Agricultural Research Institute, New Delhi.

Uses : The dry seeds are eaten in the same way as haricot beans. In Mexico the beans are sometimes soaked in water to produce a gelatinous extract used in the preparation of soups.

The tepary bean is grown as a fodder and green manure crop.

Notes : The cultivated forms belong to var. *latifolius* Freem.

2. P. coccineus L. Sp. Pl. 724. 1753 ; Maréchal *et al.* in Boissiera 28 : 137. 1978 ; Kay, Food Leg. 355. 1979 ; *P. vulgaris* L. var. *coccineus* L. Sp. Pl. ed. 2. 1016. 1763.

Runner bean, Multiflora bean, Scarlet runner bean (Eng.) ; *Sem, Urahi, Uri, Stick* or *String bean* (Hindi) ; *Sim* (Ass.).

Twining, annual-perennial herbs, hairy. Leaflets ovate-rhomboid, entire, cuneate or truncate at base, acuminate and mucronate at apex, scabrid on both surfaces with minute hooked hairs, 9-15 × 8-12 cm. Petioles up to 10 cm long. Stipules triangular, acute to obtuse at apex. Racemes on 6-10 cm long peduncles, not tuberculate, with 4-6 pairs of flowers. Bracteoles 0.3-0.5 cm long. Calyx glabrescent, upper lobes connate into a triangular upper lip. Corolla usually scarlet, often white or variegated (red and white) ; standard 1.5-2 cm across. Pods laterally compressed, faintly tubercu-

late along sutures, beaked, 16-22-seeded, separated by septa-like tissue, 10-30 cm long. Seeds oblong, purplish black, with red mottling, rarely white, variable in size.

Lectotype : *Hortus Upsaliensis,* 899.2 (LINN).

Fls. & *Frts.* : Greater part of the year.

Ecology : Often runs wild in waste places and gardens.

Chr. No. : 2n=22 (Sinha and Roy in *Cytologia* 44 : 201-209, 1979).

Distribution : Native of Mexico ; cultivated in gardens of plains and Himalayas in India—Himachal Pradesh, Uttar Pradesh, Assam.

Uses : Immature pods are used as a vegetable. Dry seeds are used as a pulse, and fresh ones are used as a vegetable. The tuberous roots are used as a starchy foodstuff, after boiling.

Notes : Three cultivars are recognized—*rubronanus* which is a bushy type with red flowers ; *albus* which is a white Dutch runner ; and *albonanus* which is a bushy form with white seeds.

Maréchal *et al.* recognized 4 subspecies—*coccineus, obvallatus* (Schlecht.) Maréchal *et al., formosus* (H.B.K.) Maréchal *et al.* and *polyanthus* (Greenman) Maréchal *et al.* The cultivated forms belong to subsp. *coccineus.*

3. Phaseolus lunatus L. Sp. Pl. 724. 1753 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 200. 1876 ; Gamble, Fl. Pres. Madr. 1 : 263. 1918 (Repr. ed. 1 : 256. 1957) ; Westphal in Agric. Doc. Agric. Res. Rep. 815 : 1974 ; Maréchal *et al.* in Boissiera 28 : 144. 1978 ; Kay, Food Leg. 224. 1979. *P. inomoenus* L. Sp. Pl. 724. 1753.

Lima bean, Butter bean, Madagascar bean, Burma-Rangoon bean, Sieva bean (Eng.) ; *Double bean, Sem, Zobiya* (Hindi) ; *Sewee bean* (USA) ; *Khasikollu* (Tam.).

Suberect or twining, herbs, glabrescent or pubescent. Leaflets ovate-triangular to deltoid, with a narrowed or acuminate apex, often obtuse and mucronate, 5-11 × 3-9 cm, lateral ones oblique. Petiole up to 4-12 cm long. Stipules ovate-triangular, acute, 0.5 × 0.2 cm. Racemes 3-12 cm long (incl. 0.5-4 cm long peduncle), 1-15-tubercled. Flowers 2-4 per tubercle, on 0.5-1.5 cm long pedicels. Bracteoles ovate, 1.5-2.5 cm long. Calyx campanulate, pubescent, 0.2-0.3 cm long. Standard densely hairy, green on the back, white or lilac on the innerside, emarginate, 0.7-1 cm across. Pods sword-shaped, yellowish-brown, beaked, glabrous, 5-12 × 1.5-2.5 cm. Seeds 2-6 per pod, red, brown, black or white, 1-2.5 cm long.

Neotype : Ethiopia : *Westphal* 8622 (WAG).

Fls. : Aug.-Sept. *Frts.* : Sept.-Oct.

Distribution : Native of Guatemala ; cultivated in cool temperate regions of India (up to 3000 m in Himalayas), particularly in hills and mountains, Uttar Pradesh, Assam, Sikkim, Maharashtra, Karnataka, Tamil Nadu, Andaman Islands.

Uses : The green immature pods are used as a vegetable. Dried seeds are used as a pulse.

Dry beans are used for the production of a protein-rich bean flour. In Japan the beans are used for the production of bean paste. Lima beans are sometimes used for cattle food.

It is also used as a fodder and green manure crop.

Notes : Some taxonomists (Bailey in Genet. Herb. 4 : 336-41. 1940) segregate *P. limensis* as distinct from *P. lunatus.* The former includes large-seeded types, whereas the latter encompass all small, baby limas or sieva bean type.

van Eseltine (New York State Agric. Exp. Stn. Geneva, Tech. Bull. : 182. 1931) recognized five forms—*macrocarpus* (flat

lima bean); *salcis* (willow-leaf sieva lima bean); *lunonanus* (bush type sieva lima bean); *limenanus* (bush type large-seeded lima bean) and *solanoides* (potato lima bean).

The cultivars in India belong to *macrocarpus* form (flat lima bean type).

The five species of *Phaseolus* adopted by DeCandolle (Prodr. 2 : 393, 394. 1825)—*P. derosus* Schrank, *P. xuaresii* Zucc., *P. macrocarpus* Poir., *P. puberulus* HBK and *P. tunkinensis* Lour., are also considered as synonyms of *P. lunatus*. The other conspecific taxon is *P. rufus* Jacq.

Maréchal *et al.* (*loc. cit.*) recognized two varieties—*lunatus* proper and *silvester* Baudet. Within the var. *lunatus*, the cultivars were grouped into three cultivar-groups (cv.-gr.)—Sieva, Potato and Big Lima. Most of these cultivars are grown in India.

4. Phaseolus vulgaris L. Sp. Pl. 723. 1753; Baker in Hook. f. Fl. Brit. Ind. 2 : 200. 1876; Gamble, Fl. Pres. Madr. 1 : 363. 1918 (Repr. ed. 1 : 256. 1957). Westphal in Agric. Doc. Agric. Res. Rep. 815 : 1974; Maréchal *et al.* in Boissiera 28 : 136. 1978; Kay, Food Leg. 124. 1979.

Haricot bean, Common bean, Field bean, French bean, Kidney bean, Pole bean, Runner bean, Snap bean, String bean (Eng.); *Bunchu-Kai* (Tam.); *Frash bean, Rajmah* (Hindi); *Cranberry bean* (USA).

Tall and twining or low and erect, annuals, hairy. Leaflets ovate-deltoid, acuminate or rounded and mucronate at apex, rounded to truncate-subcuneate at base, pubescent on both surfaces, 5-15 × 3-10 cm. Petiole up to 7 cm long. Stipules broadly lanceolate, foliaceous, 0.5-2 cm long. Racemes lax, few-flowered (2-4), not tuberculate, on 6 cm long peduncles. Flowers solitary or in pairs, on 0.5-0.8 cm long pedicels. Bracteoles ovate, glabrescent, 0.4 × 0.2 cm. Calyx slightly pubescent, lobes subequal, triangular, acute or acuminate, 0.4 cm long. Corolla white, turning yellow, sometimes violet, 1-1.5 cm long; standard 0.9-1.5 cm across. Pods slender, beaked, laterally compressed, seeds 1-12 per pod, 8-14 × 0.4-1.5 cm. Seeds white, yellow, red, lilac, brown or black, vary in shape and size.

Lectotype : *Hortus Upsaliensis* 899.1 (LINN).

Chr. No. : 2n=22 (Sarbhoy in *Cytologia* 42 : 401-413. 1977).

Distribution : Native of Mexico-Guatemala area; cultivated as a summer crop in Himalayas (up to 3000 m in Himalayas) and Western Ghats, Punjab, Himachal Pradesh, Uttar Pradesh, West Bengal, Assam, Sikkim, Karnataka, Tamil Nadu.

Uses : Seeds are widely used as a human protein foodstuff. The beans are canned as baked beans, and are used for the production of protein concentrates. Green beans are used as a vegetable. The immature, unshelled green pods of French or snap bean types (horticultural types) are widely used as a vegetable—fresh, canned, dehydrated or quick frozen. Green leaves are sometimes used as a salad ingredient. Cull dry beans can be used, after cooking, for livestock or poultry feed. It is also used as a fodder.

Notes : Highly polymorphic species, and comprises several hundreds of cultivars. These cultivars can be grouped into three categories : (i) Dry-shell or field beans which are grown for their dry, fully mature seeds; (ii) Green-shell haricot beans which are grown for the mature, fully developed beans harvested from mature but not dry pods (the white, green, red-seeded 'Flageolet' types of France such as Michelet and Coco belong to this group) and (iii) Horticultural haricot beans which are grown for their immature pods for use as a vegetable, and are known as French, snap or string beans.

The dry-shell or field beans can be further classified into the following types based on the variation in the colour of seed coat, size and shape of seed, growth period, besides resistance to pests and diseases :

(i) Pea or Navy beans—seeds less than 0.8 mm length, not reniform. Grown for canning purpose.

(ii) Medium haricot beans—seeds 0.9-1.2 cm length and their thickness less than half the length.

(iii) Marrow beans—medium to large seeds of 1-1.5 cm long, and their thickness exceeding half the length.

(iv) Kidney beans—seeds 1.5 cm or more in length and more or less reniform in shape. The colour may be white, various shapes of red or purple.

Most of these cultivars are grown in India.

Phaseolus romanus Savi, *P. oblongus* Savi, *P. tumidus* Savi, *P. sphaericus* Savi, *P. gonospermus* Savi, *P. haematocarpus* Savi, *P. esculentus* Salis. and *P. compressus* DC. have been considered as conspecific with *P. vulgaris* (Westphal, *loc. cit.*).

Mansfield (Prodr. Enum. Sp. Pl. Agri-Hort. 210. 1959) recognized two subspecies—*aborigineus* (Burkart) Mansf. which includes all cultigens. Recently, subsp. *aborigineus* has been considered as a distinct species—*P. aborigineus* Burkart (refer Verdc. in Kew Bull. 24 : 1970). However, Maréchal *et al.* (*loc. cit.*) maintained *P. aborigineus* as a variety of *P. vulgaris.*

4. Vigna

Savi in Pisa Nuov. Giorn. 8 : 113. 1824 ; Benth. & Hook. f. Gen. Pl. 1 : 539. 1865 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 204. 1876 *pro parte* ; Cooke, Fl. Pres. Bomb. 1 : 379. 1902 (Repr. ed. 1 : 400. 1958) ; Gamble, Fl. Pres. Madr. 1 : 364. 1918 (Repr. ed. 1 : 257. 1957) ; Duthie, Fl. Upp. Gang. Pl. 1 : 227. 1903 (Repr. ed. 1 : 226. 1973) ; Haines, Bot. Bih. Oris. 1 : 289. 1925 (Repr. ed. 1 : 303. 1961). Hutchinson, Gen. Fl. Pl. 1 : 436. 1964 ; Verdc. in Kew Bull. 24 : 526. 1970 ; Maréchal *et al.* in Boissiera 28 : 160. 1978 ; *Cochliasanthes* Trew, Pl. Rar. 41. t. 10. 1763. *Cadelium* Medik in Vorles. Churpf. Phys. Ges. 2 : 352. 1787. *Phaseolus* Benth. Comm. Leg. Gen. 76. 1837 *pro parte ;* Baker in Hook. f. Fl. Brit. Ind. 2 : 200. 1876 *pro parte. Dolichovigna* Hayata, Ic. Pl. Formos. 9 : 35. 1920. *Azukia* Ohwi in Fl. Japan 690 : 1953 et in Bull. Nat. Sci. Mus. Tokyo 33 : 77. 1953. *Rudua* Maekawa in Jap. J. Bot. 15 : 114. 1955. *Haydonia* Wilczek in Bull. Jard. Bot. Brux. 24 : 405. 1954 ; Maréchal in Bull. Jard. Bot. Belg. 37 : 461. 1967.

Twining or erect herbs. Leaves pinnately 3-foliolate, stipellate. Stipules mostly produced below the point of attachment, often truncate or bilobed at base, rarely not produced below the point of attachment, often peltate, persistent. Racemes peduncled, axillary, tubercled. Bracts and bracteoles small, caducous. Calyx nearly campanulate, 2 upper lobes connate or free. Standard orbicular, usually with basal inflexed appendages ; wings rather shorter than the standard, and almost equal to the keel ; keel slightly incurved not more than 180° or strongly incurved through 360°, very rarely makes 5-7 complete turns (180°-250°), obtusely or narrowly beaked or not, often canoe-shaped, with or without pockets on the left hand side. Stamens diadelphous ; anthers uniform. Ovary sessile ; style with thickened part straight or incurved, together with keel, through about 180°-340° without or with a short upturned beak beyond the stigma, often obliquely hoof-shaped ; stigma very oblique or introrsely lateral. Pods straight or slightly incurved, terete to subcompressed or compressed. Seeds vary in shape, size and colour, estrophiolate.

Type species : *V. luteola* (Jacq.) Benth.

Distribution : About 150-200 species of

mostly tropical African and Asian in distribution. In India, there are 23 species; most of the species are wild in hilly tracts and in mountains (up to 2000 m in Himalayas); a few of them constitute major pulse crops, and are exclusively found under cultivation.

1a. Pods 0.8-1 cm broad .. 2. *V. adenantha*
1b. Pods up to 0.5 cm broad:
  2a. Keel incurved through 180°-250° (5-7 complete turns) with a very marked pocket on the left hand side. Style with a thickened part incurved through 180°-340°, and with a short, lobe-like appendage and subterminal stigma .. 23. *V. vexillata*
  2b. Keel not as above, with or without a pocket. Style with a thickened part only slightly incurved or incurved through 180°-340°:
    3a. Thickened part of style scarcely incurved. Keel narrowly beaked, incurved, without a pocket:
      4a. Stipules bilobed (cordate) at base. Style with a thickened part slightly incurved, only shortly beaked or not. Keel not curved back through 180°:
        5a. Pods 1-2 cm long, 1-3 (−4)-seeded. Limb of standard 0.6-1.2 cm across .. 10. *V. hosei*
        5b. Pods 2.5-7 cm long, more than 4-seeded. Limb of standard more than 1.5 cm across:
          6a. Leaflets obovate, obtuse, somewhat fleshy, 5-10.5×3.5-8.5 cm. Pedicels 0.3-0.6 cm long .. 13. *V. marina*
          6b. Leaflets ovate, acuminate, not fleshy, 2.5-5×1-2 cm. Pedicels 0.2-0.3 cm long .. 12. *V. luteola*
      4b. Stipules entire at base. Thickened part of style hoof-shaped at apex. Keel with a narrow produced beak curved back through 180°:
        7a. Pods glabrous. Standard with 'X'-shaped callus at base .. 8. *V. grahamiana*
        7b. Pods hairy. Standard without appendages at base:
          8a. Corolla yellow. Leaflets narrowly ovate-oblong .. 5. *V. clarkei*
          8b. Corolla lilac. Leaflets ovate-deltoid .. 15. *V. pilosa*
    3b. Thickened part of style variously incurved. Keel not beaked:
      9a. Pockets on the keel absent. Style with a thickened part slightly incurved and with a short, upturned beak beyond the stigma .. 22. *V. unguiculata*
      9b. Keel with a distinct upwardly directed pocket on the left side. Style with a thickened part strongly curved, and prominently and slenderly beaked beyond stigma:
        10a. Plants rooting at nodes. Creepers .. 6. *V. dalzelliana*
        10b. Plants not rooting at nodes. Not creepers:
          11a. Stipules foliaceous, obovate, 3-5 cm long. Racemes 10-15-(30)-tubercled. Bracts and bracteoles boat-shaped .. 11. *V. khandalensis*
          11b. Stipules not foliaceous, oblong or linear-lanceolate. Bracts and bracteoles not boat-shaped:
            12a. Leaflets palmately 3-lobed to -partite. Pods terete. Plants prostrate or decumbent-ascending or erect, never twining:
              13a. Stipules linear-lanceolate, 0.9×0.25 cm. Racemes on short peduncles, up to 10 cm long, 1-6-flowered. Flowers less than 1 cm long .. 1. *V. aconitifolia*
              13b. Stipules ovate-oblong, peltate, with a cordate base, 1.5×1 cm. Racemes on long peduncles, up to 30 cm long, more than 6-flowered. Flowers exceed 1 cm long .. 20. *V. trilobata*
            12b. Leaflets entire or shallowly lobed at base. Pods terete or compressed. Plants erect to twining:
              14a. Pods distinctly compressed, glabrous, reflexed. Racemes many-tubercled:
                15a. Pods fleshy, more than 0.4 cm broad. Racemes paniculate 18. *V. ricciardiana*
                15b. Pods not fleshy, narrower than the above. Racemes not paniculate .. 21. *V. umbellata*
              14b. Pods terete or subcompressed, erecto-patent, or patent, not reflexed:
                16a. Pods terete to subterete, glabrous to minutely setosely hairy:
                  17a. Stipules broadly ovate-oblong, peltate, not truncate at base. Pods distinctly terete. Plants twining, long-hairy 9. *V. hainiana*
                  17b. Stipules truncate at base. Pods subterete. Plants suberect or twining only in the top, glabrescent:
                    18a. Pods up to 10 cm long. Racemes 6-12-flowered. Plants stout .. 3. *V. angularis*
                    18b. Pods up to 5 cm long. Racemes less than 6-flowered. Plants slender, elegant .. 16. *V. prainiana*
                16b. Pods subcompressed, clothed with long, brownish hairs:

19a. Plants stout twiners, clothed with dense, ferruginous hairs. Flowers large. Racemes many-tubercled, up to 2 cm long .. 4. *V. bourneae*
19b. Plants not as above, not densely ferruginous-hairy. Flowers small, up to 1.5 cm long. Racemes few tubercled :
20a. Pods glabrous .. 7. *V. glabrescens*
20b. Pods hairy :
21a. Pods bristly hairy with short appressed hairs. Seeds green or yellow, never black in colour. Plants erect or suberect. Hypocotyl of seedlings glabrous. Racemes elongated .. 17. *V. radiata*
21b. Pods densely hairy with long hirsute hairs. Seeds black or greyish black or brown, never green or yellow. Hypocotyl of seedlings hairy. Racemes capitate :
22a. Stipules broadly ovate-oblong, peltate. Seeds not brown. Racemes many-flowered. Flowers up to 1.4 cm long. Calyx-lobes 0.35-0.45 cm long. Plants diffusely branched with twining or prostrate branches .. 14. *V. mungo*
22b. Stipules falcate-lanceolate. Seeds brown, greyish brown or mottled. Racemes few-flowered. Flowers up to 1 cm long. Plants sparsely branched, erect or suberect or rarely twining. Calyx-lobes 0.2-0.25 cm long. .. 19. *V. sublobatus*

1. Vigna aconitifolia (Jacq.) Maréchal in Bull. Jard. Bot. Nat. Belg. 39 : 160. 1969 ; Maréchal *et al.* in Boissiera 28 : 213. 1978 ; Verdc. in Kew Bull. 23 : 464. 1969 et 24 : 557. 1970. *Phaseolus aconitifolius* Jacq. Obs. Bot. 3 : 2. t. 52. 1768 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 202. 1876 ; Gamble, Fl. Pres. Madr. 1 : 363. 1918. (Repr. ed. 1 : 256. 1957) ; Duthie, Fl. Upp. Gang. Pl. 1 : 225. 1903 (Repr. ed. 1 : 226. 1973) ; Haines, Bot. Bih. Or. 1 : 288. 1925 (Repr. ed. 1 : 301. 1961).

Moth bean, Mat bean (Eng.) ; *Mooth, Moth, Bhringga* (Hindi) ; *Kheri* (Beng.) ; *Mut, Math* (Guj.) ; *Madik* (Kan.) ; *Math, Matki* (Mr.) ; *Bhioni* (Punjabi) ; *Birmung, Moch, Birmoch* (Santal) ; *Kallupayaru, Nari payaru, Pani payaru* (Tam.) ; *Kuncuma pesalu* (Tel.) ; *Turkish gram* (USA).

Erect or prostrate to decumbent-ascending, annual to perennial herbs. Stems, petioles, foliage and peduncle pubescent with patent, slightly deflexed, creamish hairs. Leaflets subsessile or on 0.1-0.15 cm long petioles, palmately 3-lobed to -partite ; lateral lobes very frequently 2-lobed ; ultimate segments narrowly lanceolate-oblong, obtuse-subacute, with a cuneate base, ciliate. Petiole 1-8 cm long. Stipules linear-lanceolate, acuminate, ciliate, 0.9 × 0.25 cm. Racemes capitate, up to 10 cm long (incl. peduncle). Flowers on 0.2 cm long pedicel. Bracteoles linear, ciliate, up to 0.3 cm long. Calyx 0.2 cm long. Corolla yellow, 0.7 cm long. Pods cylindric, glabrous, 6-8-seeded. Seeds brown, 0.4 × 0.3 cm.

Type : India : Madras, *Hort. Sicc.* Petv. (in ed.) (BM—lectotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : The wild forms occur along roadsides and bunds of fields.

Chr. No. : 2n=22, 44 (Maréchal in Bull. Jard. Bot. Nat. Belg. 40 : 307-348. 1970 ; Subramaniam in Proc. 64th Ind. Sci. Congr. 3 : 159. 1977).

Distribution : Cultivated throughout India (up to 1320 m in Himalayas), particularly in arid and semiarid tracts, Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar, Orissa, Assam, Gujarat, Maharashtra,

Karnataka, Tamil Nadu, Andhra Pradesh ; wild in Orissa. AUSTRALIA, COSTA RICA.

Uses : Moth bean is grown in arid and semiarid tracts as a kharif pulse crop. The seed is used as a pulse and also as a savoury dish. The immature pods are sometimes boiled and eaten as a vegetable.

The flour prepared by grinding the seeds is used in the preparation of unleavened bread. The seeds may be processed for starch which is useful for textile-sizing and calico printing. The ripe seeds are utilized for livestock feeding. The moth bean is also grown as a forage crop. Since it forms mats, it can be effectively used for soil conservation and for controlling soil erosion.

Notes : The cultivated forms are remarkably different from wild one in habit and lobing of leaflets. The wild form is invariably prostrate with deeply lobed leaves, and possess shattering pods, whereas the cultigens are erect or decumbent-ascending with variously dissected leaves, and the pods are non-shattering type.

V aconitifolia is closely related to *V. trilobata*, and is probably the putative progenitor of the latter. It differs from *V trilobata* in having linear-lanceolate, long stipels, lanceolate stipules, deeply dissected leaflets with narrow segments, shorter pods and larger seeds.

2. Vigna adenantha (G. F. Meyer) Maréchal, Mascherpa et Stainier in Taxon 27 : 202. 1978 ; Maréchal *et al.* in Boissiera 28 : 229. 1978. *Phaseolus adenanthus* G. F. Meyer, Prim. Fl. Esseq. 239. 1818 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 200. 1876 ; Gamble, Fl. Pres. Madr. 1 : 363. 1918 (Repr. ed. 1 : 255. 1957). *P. rostratus* Wall. Pl. Asiat. Rar. t. 63. 1830. *P. alatus* Roxb. Fl. Ind. (ed. Carey) 3 : 288. 1832.

Karlsona (Tam.).

Twining or trailing, perennial herbs with a tuberous rootstock, glabrescent. Leaflets ovate, acute, entire, 6.5-9 × 1.5-5 cm. Petioles 3-8 cm long. Stipules lanceolate, 0.8 × 0.3 cm. Racemes on 5-15 cm long peduncles, 6-10-flowered. Calyx 0.6-0.8 cm long, lobes linear. Corolla 1.1-1.5 cm long. Pods recurved, laterally compressed, beaked, glabrous, 11-14 × 0.8-0.9 cm, septate between seeds ; seeds 12-20 per pod. Seeds oblong, black.

Type : Rio Essequido Guyama, *Rodschied, s. n.* (GOET—holotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : Found along roadsides and waste places.

Chr. No. : 2n=22 (Maréchal in Bull. Jard. Bot. Nat. Belg. 40 : 307-348. 1970).

Distribution : Native of S. America ; naturalized and often cultivated in India, Bihar, West Bengal, Orissa, Madhya Pradesh, Tamil Nadu, Andaman Islands.

Uses : Tubers are used as a starchy foodstuff, after boiling. The dried beans are often used as a pulse.

An excellent soil conservation crop.

3. V. angularis (Willd.) Ohwi et Ohashi in J. Jap. Bot. 44 : 29. 1969 ; Verdc. in Kew Bull. 24 : 557. 1970 ; Maréchal *et al.* in Boissiera 28 : 214. 1978. *Dolichos angularis* Willd. Sp. Pl. 3 : 1051. 1802. *Phaseolus angularis* (Willd.) W. F. Wight in U. S. Dept. Agric. Bur. Pl. Intr. Bull. 137 : 17. 1909.

Adzuki bean, Adsuki, Atsuki, Atzuki, Rod bean or Azuki bean (Eng.).

Erect, bushy annuals, glabrous to glabrescent. Leaflets ovate-lanceolate to oblong, acute or acuminate, cuneate-deltoid at base, often faintly lobed. Stipules lanceolate, 1.2 × 0.1-0.2 cm. Racemes dense, 6-12-flowered. Bracts lanceolate, 0.8 cm long. Bracteoles linear, 0.8-0.9 cm long. Calyx 0.3-0.4 cm long. Corolla 1.2-1.5 cm long. Pods erecto-patent, straw-coloured, 4-10-seeded, 7.5-10

cm long. Seeds variously coloured, usually maroon.

Type : *Willdenow* 13419 (B—holotype).

Fls. : Aug.-Sept. *Frts.* : Oct.-Nov.

Chr. No. : 2n=22 (Joseph and Bouwkamp in *Cytologia* 43 : 595-600. 1978).

Distribution : Probably native of China and Japan ; cultivated on a limited scale in hilly areas of India. Uttar Pradesh, Assam, Sikkim and Tamilnadu ; CHINA, JAPAN, VIETNAM.

Uses : Beans of maroon coloured types are used as a foodstuff in Japan where they are boiled or fried, and often eaten with rice or ground and used as a paste or a flour in the preparation of cakes, sweetmeats, etc. The whole beans are often 'popped' or candied. The seeds are also used as a vegetable after sprouting, and may be employed as an ingredient for soups or gruels or split and used for dhal.

The adzuki bean is sometimes grown as a green manure crop or for livestock feeding. It has been used as a coffee substitute and in the manufacture of cosmetics.

Notes : In Japan there are two types—the common adzuki bean and the large-seeded adzuki bean or Dainagon. The cultivar Chagara were of common adzuki bean type has a short stem, light-brown pods and small seeds. Akatsuki-dainagon is a recent high-yielding cultivar of the large-seeded Dainagon type.

Two taxonomic varieties are recognized-*angularis* and *nipponensis* (Ohwi) Ohwi et Oshashi (=*Phaseolus nipponensis* Ohwi in J. Jap. Bot. 13 : 435. 1937). The variety *angularis* is grown in India.

4. Vigna bourneae Gamble, Fl. Pres. Madr. 365. 1918. (Repr. ed. 1 : 257. 1957) et in Bull. Misc. Inf. Kew 1919 : 224. 1919 ; Verdc. in Kew Bull. 24 : 561. 1970. Maréchal *et al.* in Boissiera 28 : 217. 1978.

Stout twiners. Stems, petioles and peduncles densely ferrugineous-pubescent. Leaflets ovate, entire, acuminate, densely ferruginous-villous on both surfaces, 8-12 × 5.5 cm. Petiole up to 10 cm long. Stipules peltate, oblong-lanceolate, 1-1.5 cm long. Racemes many-tubercled, elongate, on 20 cm long peduncles. Bracteoles oblong-lanceolate. Calyx 0.5 cm long. Corolla bright yellow, 1-1.5 cm long. Pods subcompressed, densely ferrugineous-villous, 10-12-seeded, 5-6 cm long. Seeds 0.2-0.3 cm long.

Lectotype : India : Pulney Hills, Madura District, Poombarai riverside, December 18, 1898, *Bourne* 1291 (K).

Fls. : Sept.-Oct. *Frts.* : Nov.-Dec.

Ecology : A rainforest species.

Distribution : INDIA : Western Ghats, Tamil Nadu ; endemic.

Notes : Very remarkable species, and is allied to *V. sublobata*. *V. bourneae* differs from the latter in having large flowers, long, many-tuberculate racemes, larger leaflets and ferrugineous-villous indumentum of herbage.

5. V. clarkei Prain in J. Asiat. Soc. Beng. 66 : 429. 1897 ; Verdc. in Kew Bull. 24 : 561. 1970.

Slender, trailing or twining herbs. Stems appressedly, densely hairy with reflexed hairs. Leaflets narrowly ovate-oblong, acute to shortly acuminate, subtruncate at base, appressedly bristly hairy, lateral ones shallowly lobed at base, terminal one 11-13 × 3-4 cm. Petiole up to 7 cm long. Stipules narrowly lanceolate, 0.5 × 0.2 cm. Racemes 2-7-tubercled, up to 12 cm long (incl. peduncle). Flowers shortly pedicellate. Calyx villous, 0.4 cm long. Corolla yellow, 0.9-1 cm long. Pods terete, densely clothed with rusty-brown hairs. Seeds not seen.

Type : India : Sikkim Terai, Dalkajhar alt. 165 m, Oct. 14, 1884, *Clarke* 37032 (K—lectotype ; CAL—isolectotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : A grassland species.

Distribution : INDIA : Tropical Eastern Himalaya, West Bengal, Assam, Sikkim ; endemic.

Notes : Very close to *V. vexillata* var. *angustifolia* in foliage, but differs in having greyish-silky reflexed hairs on stem, leaves and peduncles, 6-7-tubercled racemes, small flowers and deltoid calyx-lobes.

6. Vigna dalzelliana (O. Kuntze) Verdc. in Kew Bull. 24 : 558. 1970 ; Maréchal *et al.* in Boissiera 28 : 216. 1978. *Phaseolus dalzellianus* O. Kuntze, Rev. Gen. 1 : 202. 1891. *P. pauciflorus* Dalz. in Hook. J. Bot. 3 : 209. 1851 *non* G. Don, 1832 *nec* Benth. 1837 ; Dalz. & Gibs Bomb. Fl. 72. 1861. ; Baker in Hook. f. Fl. Brit. Ind. 2 : 202. 1876 ; *P. dalzellii* Cooke, Fl. Pres. Bomb. 1 : 376. 1903 (Repr. ed. 1 : 401. 1958) ; Gamble, Fl. Pres. Madr. 1 : 363. 1918 (Repr. ed. 1 : 256. 1957).

Mugavaine (Guj.) ; *Magauel, Ranmug* (Mar.).

Creeping herbs. Stems grey-hairy when young, glabrescent when mature, rooting at nodes. Leaflets ovate-rhomboid to ovate-deltoid, acuminate, membranous, entire or faintly lobed, 3-3.5 × 1-1.2 cm. Petiole 1-4 cm long. Stipules narrowly lanceolate. Racemes on 2-4 cm long peduncles, 1-2-tubercled. Bracteoles longer than calyx. Calyx minutely hairy, 0.2-0.3 cm long. Corolla yellow, 0.6 cm long. Pods 4-10-seeded, compressed, reflexed, glabrous or thinly hairy. Seeds chestnut brown, 0.2 × 0.2 cm.

Type : India : Western Ghats, *Dalzell s. n.* (K—holotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : Forms a component of the ground flora of monsoon forest, particularly of Sal forests.

Chr. No. : 2n=22 (Bir and Kumari in *Taxon* 27 ; 53-61. 1978).

Distribution : INDIA : Western Ghats and hilly tracts of Central India, Maharashtra, Karnataka, Kerala, Tamil Nadu, Orissa, Madhya Pradesh, Bihar ; KAMPUCHEA (CAMBODIA), PHILIPPINES, THAILAND, VIETNAM.

Uses : Livestock often grazes on the tender herbage. It is an excellent soil-binder, and can be grown for soil conservation.

Notes : Very closely resembles *V. hosei* in vegetative morphology, but *V. hosei* is characterised by short, few-seeded, hairy pods in contrast to long, many-seeded, glabrous pods of *V dalzelliana.*

7. V. glabrescens Maréchal, Mascherpa et Stainer in Taxon 27 : 201. 1978 ; Maréchal *et al.* in Boissiera 28 : 212. 1978. *Phaseolus glaber* Roxb. Fl. Ind. (ed. Carey) 3 : 291. 1832 (*non V. glabra* Savi 1825). *P. mungo* L. var. *glaber* (Roxb.) Baker in Fl. Brit. Ind. 2 : 203. 1876. *Vigna radiata* (L.) Wilczek var. *glabra* (Roxb.) Verdc. in Kew Bull. 24 : 588. 1970.

Annual herbs. Branches erect-ascending, reaching to a height of 1 m. Stems stout, glabrous. Leaflets broadly ovate, abruptly acuminate, entire. Racemes long-peduncled, 4-5-tubercled. Flowers large and bright yellow. Standard very broad, reniform ; keel with a long, pointed horn. Pods compressed, patent, with a distinct beak, glabrous, 7.5-10.0 cm long. Seeds 10-12, oblong with truncate ends, dark-brown with greyish specks.

Type : *W. roxburgh s. n.* (BR—holotype ; K—isotype).

Chr. No. : 2n=44 (Maréchal in *Bull. Jard. Bot. Nat. Belg.* 40 : 307-349. 1970).

Distribution : INDIA : Often cultivated

probably in West Bengal and Orissa ; JAPAN, PHILIPPINES, MAURITIUS, VIETNAM.

Notes : No material was seen.

8. Vigna grahamiana (Wt. et Arn.) Verdc. in Kew Bull. 24 : 562. 1970, Maréchal *et al.* in Boissiera 28 : 231. 1978. *Phaseolus grahamianus* Wt. et Arn. Prodr. 244. 1834 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 201. 1876 ; Gamble, Fl. Pres. Madr. 1 : 362. 1918 (Repr. ed. 1 : 256. 1957). *Dolichos subcarnosus* Wt. & Arn. 249. 1834.

Twining, glabrous herbs. Stems stout. Leaflets ovate-deltoid, acute-acuminate, cuneate at base, 6-6.5 × 3-4 cm. Petiole up to 6 cm long. Stipules minute, narrowly ovate-lanceolate. Racemes 2-many-tubercled, 4-12 cm long (incl. peduncle). Pedicels up to 0.04 cm long. Calyx-lobes deltoid. Corolla reddish, 1 cm long ; keel recurved up to 180° or more, but not more than 270°. Style bearded below the stigma. Pod compressed, slightly recurved, 6-8-seeded, up to 9 cm long.

Type : India : Western Ghats, *Wight* 724 (K—holotype).

Fls. : Oct. *Frts.* : Nov.-Dec.

Ecology : A rainforest species.

Distribution : INDIA : Western Ghats, Tamil Nadu ; SRI LANKA.

Notes : Seems to be threatened. An interesting species that forms a connecting link between *Vigna* and *Dolichos*.

9. V. hainiana Babu, Gopinathan & Sharma, *nom. nov. Phaseolus wightii* W. & A. Prodr. 215. 1834 *non Vigna wightii* Benth. ex Baker, 1876. *Phaseolus wightianus* Grah. ex Wall. Num. List. No. 5604. 1831-1832, *nom. nud. P. subvolubilis* Buch.-Ham. ex Wall. Num. List. No. 5605. 1831-1832. *P. mungo* var. *wightianus* Baker in Hook. f. Fl. Brit. Ind. 2 : 203. 1876. *P. calcaratus sensu auctt. mult. non* Roxb. 1832 ; Haines Bot. Bih. Or. 1 : 288. 1925 (Repr. ed. 1 : 301. 1961). *P. sublobatus* sensu Duthie, Fl. Upp. Gang. Pl. 1 : 226. 1903 (Repr. ed. 1. 226. 1973).

Twining, hirsutely hairy, annual herbs. Stems, petioles and peduncles clothed with deflexed, greyish or greyish-brown hairs. Leaflets ovate-deltoid, appressedly long-hairy on both surfaces, acuminate at apex, 4-12 × 3-6 cm, lateral ones shallowly lobed at base. Petiole 5-8 cm long. Stipules oblong to linear-lanceolate, often bilobed at base, 0.6-1.5 × 0.3-0.5 cm. Racemes on 5-15 cm long peduncles, 2-5 (-15)-tubercled. Corolla yellow, 1.2 cm long ; keel without horn. Pods terete, glabrous or setosely hairy, 6-12-seeded, 4-7 cm long. Seeds blackish-grey or brown, 0.3 × 0.2 cm.

Lectotype : India : Western Ghats *Wight* 1836 (K).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : A species found as an undergrowth in sal forests.

Chr. No. : 2n=22 (Gopinathan & Babu in *Cytologia* 1985).

Distribution : INDIA : Tropical Himalayas and hilly tracts—Uttar Pradesh, Bihar Assam, W. Bengal, Orissa, Madhya Pradesh, Tamil Nadu.

Uses : The beans are consumed as a pulse during famines.

Notes : A remarkable forest dwelling species and is the putative progenitor of *V. radiata.* It was hitherto confused with *V. calcarata,* but is readily distinguishable from the latter by patent terete pods, peltate stipules, and long, greyish or greyish-brown hairs and seeds which are oblong with truncate ends. *V. hainiana* is closely related to *V radiata* but differs from the latter in having flexuous stems, large peltate stipules, long, greyish or greyish-brown hairs on stems and petioles, twining habit

and lobed leaflets. The pod and seed characters resemble *V. radiata*.

10. Vigna hosei (Craib) Backer in Backer et van Slooten, Geillustreerde Handbook Voor de Thee-onkruiden 153. 1924; Backer et Bakh. f. Fl. Java 1 : 642. 1963; Maréchal *et al.* in Boissiera 28 : 172. 1978. *Dolichos hosei* Craib in Bull. Misc. Inf. Kew 1914 : 76. 1914. *Vigna oligosperma* Backer *nom. nud.*; Mededeeling Algemeen Proefstation von Landbouw, Buit. 16 : 58, 61, 1924; Whyte, Nilsson-Leissner et Trumble in F.A.O. Agric. Studies No. 21 : 344. 1953.

Creeping herbs. Stems slender, rooting at nodes. Leaflets ovate-elliptic to rounded, abruptly acuminate or obtuse, entire, thinly hairy on both surfaces; terminal leaflet 3-7 × 2-5 cm. Stipels large, foliaceous. Petiole 2-5 cm long. Stipules cordate at base. Racemes few-tubercled, on 2-7 cm long peduncles. Flowers on 0.2-0.3 cm long pedicels. Calyx-tube 0.15-0.2 cm long, upper teeth connate into a upper lip. Corolla 0.6-1 cm long. Pod 1-3-seeded, finely pubescent, 1-2 cm long. Seeds black.

Type : Malaysia : Selangor, Kuala Lumpur, *Director Agriculture Hose* 2335/1913 (ex : Borneo) (K—holotype).

Distribution : Native of N. Borneo; introduced in India, Kerala, Orissa; SRI LANKA, MALAYSIA, INDONESIA, BORNEO, TANZANIA, MOZAMBIQUE.

Uses : An excellent soil-binder. It is grown as a cover crop in rubber plantations. It is also used for soil conservation and for controlling soil erosion.

Notes : Appears to be a cultigen of *V dalzelliana*. *V. hosei* differs from the latter by short, 1-3-seeded, hairy pods.

The specimens collected by Mooney (2533—K) from Sambalpur in Orissa are without fruits. These were identified as *V. hosei*. But a critical examination reveals that they, in all probability, belong to *V. dalzelliana*, and not to *V. hosei*.

11. V. khandalensis (Sant.) Raghavan & Wadhwa in Curr. Sci. 41 : 429. 1972. Maréchal *et al.* in Boissiera 28 : 213. 1978. *Phaseolus khandalensis* Sant. in Kew Bull. 1948 : 276. 1948 et Rec. Bot. Surv. Ind. 16 : 68. 1967 (ed. 3). *P. grandis* Dalz. et Gibs. Bomb. Fl. 72. 1861 (*non* Buch.-Ham. ex Benth. 1852); Cooke, Fl. Pres. Bomb. 1 : 375. 1903 (Repr. ed. 1 : 400. 1958). *Vigna grandis* (Dalz. et Gibs.) Verdc. in Kew Bull. 23 : 464. 1969 et. *op. cit.* 24 : 558. 1970 (*non* Benth. 1852).

Erect, robust, branched, perennial, shrub-like herbs, 0.5-1.5 m tall. Stems fistular. Stems, petioles and peduncles clothed with deciduous, ferrugineous hairs. Leaflets variable in shape, texture, appressedly bristly hairy, palmately 3-lobed with acute lobes, up to 10 cm long. Stipels 0.6-0.7 × 0.2-0.4 cm. Petiole up to 9 cm long. Stipules foliaceous, broadly obovate, with cordate, auriculate base, acute to obtuse at apex, ciliate, prominently veined, 3-5 cm long. Racemes lax, up to 30 cm long (incl. peduncle), 10-15 (-30)-tubercled. Flowers subsessile. Bracts boat-shaped, 0.8-1 × 0.3 cm. Bracteoles obovate-oblong, 0.8 cm long. Corolla yellow, 1 cm long. Pods stalked, 6-12-seeded, appressedly bristly hairy, 6.5 × 0.5 cm. Seeds rounded, black, 0.4 × 0.3 cm.

Type : India : Western Ghats, *Dalzell*, *s.n.* (K—holotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : A rainforest species.

Distribution : INDIA : Western Ghats, Maharashtra, Karnataka; endemic.

Uses : Seed is harvested and is consumed as a pulse during famines.

Notes : An interesting species in the entire genus, and is readily distinguishable from all other species by its shrub-like

habit, large, foliaceous stipules and boat-shaped bracts.

12. Vigna luteola (Jacq.) Benth. in Mart. Fl. Bras. 15 (1) : 194. 1859 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 205. 1876 ; Prain in J. Asiat. Soc. Beng. 66 : 1897 ; Verdc. in Kew Bull. 24 : 526. 1970 ; Maréchal *et al.* in Boissiera 28 : 165. 1978. *Dolichos luteolus* Jacq. Hort. Vind. 1 : 39. t. 90. 1770. *D. repens* L. Amoen. Acad. 5 : 402. 1760. *V. repens* (L.) O. Kuntze, Rev. Gen. 1 : 212. 1891 *non* Baker, 1876. *V. brachystachyus* Benth. Bot. Voy. Sulph. 86. 1844. *Dolichos gangeticus* Roxb. Fl. Ind. (ed. Carey) 3 : 310. 1832.

Twining or creeping herbs. Leaflets ovate, subtruncate-cuneate at base, acuminate, entire, often faintly lobed, glabrescent on both surfaces, 2.5-5 × 1-2 cm. Petiole up to 7 cm long. Stipules lanceolate, acuminate, 0.5-1.5 × 0.2-0.3 cm. Racemes few-flowered, 4-20 cm long (incl. peduncle). Flowers on 0.2-0.3 cm long pedicels. Calyx glabrous, 0.5-0.6 cm long, lobes lanceolate, 0.2-0.3 cm long. Corolla yellow, 1.5 cm long ; keel recurved less than through 180°. Style bearded below the stigma. Pod stalked, subcompressed, appressedly hairy, 4-5 cm long. Seeds blackish, 4 × 0.3 cm.

Type : *Jacquin* (BM—holotype).

Fls. : Feb.-March. *Frts.* : March-April.

Ecology : A species of maritime environments.

Chr. No. : 2n=22 (Sen and Bhowal in *Cytologia* 25 : 195-207. 1960).

Distribution : INDIA : West Bengal, Andaman Islands ; SRI LANKA, BURMA, CHINA, ARGENTINA, COSTA RICA, USA, GUATAMELA, ISRAEL, KENYA, MOZAMBIQUE, SUDAN, TANZANIA, UGANDA, VIETNAM, ZAIRE, ZAMBIA.

Notes : The type at BM is without flowers and fruits, and exactly matches with the description.

Very closely allied to *V. marina,* but *V. luteola* is distinguished by its slender, herbaceous habit, narrowly ovate-elliptic leaflets which are sharply acute, and many-seeded pods.

13. V. marina (Burm.) Merr. in Int. Rumph. Herb. Amb. 285. 1917. Prain in J. Asiat. Soc. Beng. 66 : 54. 1897 ; Maréchal *et al.* in Boissiera 28 : 166. 1978. *Phaseolus marinus* Burm. Ind. Alter Univ. Amb. 18. 1769. *Dolichos luteus* Sw. Prodr. Veg. Ind. Occ. 105. 1788. *V. lutea* (Sw.) A. Gray, Bot. Wilkes U. S. Explor. Exped. 452. 1854 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 205. 1876 ; Prain in J. Asiat. Soc. Beng. 66 : 421. 1897.

Twining or decumbent herbs, glabrescent. Leaflets obovate, obtuse, subcuneate at base, entire, glabrescent or glabrous, 2-8.5 × 1.5-6 cm. Petiole up to 16 cm long, clothed with deflexed hairs. Stipules lanceolate, 0.4 × 0.2 cm. Racemes 4-24-tubercled, on 3-30 cm long peduncles. Flowers on 0.3-0.6 cm long pedicels. Calyx 0.5 cm long. Corolla 1-1.5 cm long ; limb of standard 1.3-2.2 cm across. Pods subcompressed, glabrous or thinly hairy, 3-8-seeded, 5-7 cm long. Seeds greyish brown or reddish, 0.6 × 0.5 cm.

Lectotype : Rumph. Herb. Amb. 5 : t. 141 f. 2.

Fls. : Oct. *Frts.* : Nov.-March.

Ecology : Found along the sandy coastal tracts.

Distribution : INDIA : Andaman Islands, Kerala ; BURMA, INDONESIA, MALAYSIA, TROP. AMERICA, AFRICA, AUSTRALIA, SRI LANKA, PHILIPPINES, JAPAN, VIETNAM, FIJI, HAWAI, CELEBUS.

Notes : One of the legumes inhabiting coastal tracts.

14. V. mungo (L.) Hepper in Kew Bull. 11 : 128. 1956 ; Tourneur in Riz et Rizi-

cult. 5 : 131-148. 1958 *pro parte* ; Verdc. in Kew Bull. 24 : 558. 1970 ; Maréchal *et al.* in Boissiera 28 : 209. 1978. *Phaseolus mungo* L. Mant. 1 : 101. 1767 ; Prain in J. Asiat. Soc. Beng. 66 : 421. 1897.

Urd bean, Blackgram, Mash (Eng.) ; *Urd, Urid* (Hindi) ; *Mash, Kalai, Tikari* (Beng.) ; *Adad, Arard* (Guj.) ; *Uddu, Udni bele* (Kan.) ; *Maga, Udid* (Mar.) ; *Ulundu, Ulutham, Paruppu* (Tam.) ; *Minumukulu, Karuminimulu, Manipa pappu* (Tel.).

Annual, much-branched herbs with prostrate or twining or erecto-ascending branches of 30-80 cm long, often bushy with straggling branches. Stems, petioles and peduncles densely pubescent with reflexed, greyish to greyish-brown hairs. Leaflets ovate-deltoid to ovate-rhomboid, acuminate at apex, entire or faintly lobed, 6-9 × 4-6 cm. Stipels linear-lanceolate, 0.5 cm long. Petiole 4-15 cm long. Stipules ovate-oblong, hairy, 0.7-1 × 0.4-0.5 cm. Racemes capitate, 4-8-flowered, tuberculate, on 1.5-4 cm long peduncle. Flowers yellowish, shortly pedicellate, 1-1.5 cm long. Bracteoles lanceolate, acuminate, 0.4 × 0.1 cm. Calyx up to 0.3 cm long, lobes linear. Pods subcompressed, densely, patently brown-hairy, erect or erecto-patent, 4-6 × 0.5 cm. Seeds 6-12 per pod, usually black with a concave hilum, 0.3-0.4 × 0.25-0.3 cm.

Type : Type not located at Linnean Herbarium.

Fls. : Sept.-Oct., Jan.-Feb. *Frts.* : Oct.-Nov., March-April.

Chr. No. : 2n=22, 24 (Sarbhoy in *Cytologia* 42 : 401-413. 1977 ; Rau in J. Ind. Bot. Soc. 8 : 201-206. 1929).

Distribution : Cultivated throughout India (up to 2000 m in Himalayas) ; probably originated in India. TROPICS of BANGLADESH, AUSTRALIA, GHANA, ZAIRE.

Uses : One of the major pulse crops of India, and is a very nutritious grain legume in Asia, where it is eaten whole or split, husked and unhusked or parched. The seeds are ground into a flour wnich is utilized in the preparation of various food products such as papads, a fried dough product, spiced balls and fermented products such as dosa and idli.

The seed is sometimes used as an animal feed. The green pods are occasionally eaten boiled as a vegetable. Urd is sometimes grown as a forage or green manure crop. It is also cultivated as a soil conservation crop.

Notes : Taxonomically and nomenclaturally *V. mungo* is often confused with *V radiata*. Recent population biological studies by the authors clearly suggest that it is a distinct species, and is readily recognizable by densely hairy herbage, prostrate or subscandent to twining habit, shorter, densely hirsutely hairy pods and larger, blackish to olive-brown seeds. No Linnean specimen is found at LINN.

Watt & Maréchal (in Trop. Grain Leg. Bull. 7 : 31-33. 1977) also pointed out that *V mungo* and *V. radiata* are two distinct species and listed differences between them in hairiness, seed shape and colour, seed coat structure and nature of hilum. Further, the sterility in F_1 interspecific hybrids also supports this view. The presence of a free dipeptide γ-glutamyl-S-methylcysteine in *V. radiata* and its substitution by γ-glutamyl-methionine in *V. mungo* also justifies the treatment of the two taxa as two distinct species (Otoul *et al.* in Phytochemistry 14 : 173-179. 1975).

Prain (*loc. cit.*) recognized two forms-*veera* which is characterised by hirsute stems, scandent or sub-scandent branches and black seeds, and *roxburghii* which has also hirsute stems but diffusely spread branches and grey seeds.

In Northern India urd is grown as a monsoon crop, whereas in Peninsular, southern

and eastern parts it is cultivated as a monsoon and winter crop. Cultivars suitable for growing in the plains during summer have been recently evolved. Based on the variation in colour of seeds, the different cultivars are grouped into categories-*mungo* which includes large, black-seeded, early maturing types, and *viridis* which encompass late maturing types having greenish seeds. The former category is further subdivided into ten types, whereas the latter includes fifteen types.

15. Vigna pilosa (Willd.) Baker in Hook. f. Fl. Brit. Ind. 2 : 207. 1876 ; Gamble, Fl. Pres. Madr. 1 : 365. 1918 (Repr. ed. 1 : 257. 1957) ; Prain in J. Asiat. Soc. Beng. 66 : 421. 1897. *Dolichos pilosus* Willd. Sp. Pl. 3 : 1043. 1800 ; Hosokawa in J. Soc. Trop. Agric. Taiwan 4 : 488. 1932. *Dolichovigna formosana* Hayata, Ic. Pl. Formos. 9 : 35. t. 31920 ; *Dysolobium pilosum* (Willd.) Maréchal in Bull. Jard. Bot. Natl. Belgique 47 : 483. 1977.

Thikkarai, Malkonia (Beng.).

Slender, herbaceous twiners or creepers. Stems glabrescent to densely pubescent. Leaflets ovate-deltoid, acuminate at apex, glaucous beneath, 7-15 × 3-7 cm, lateral ones subtruncate-rounded at base, terminal one cuneate at base. Petiole 4-7 cm long. Racemes 2-24-tubercled, on 1-12 cm long peduncles. Flowers on 0.2-0.3 cm long pedicels. Calyx 0.5-0.6 cm long. Corolla 1 cm long ; limb of standard pale lilac with a darker centre on the innerside ; limb of wings 0.6-0.9 cm long. Upper half of the stigma with a semicircular group of hairs below the stigma. Pods subcompressed, densely pubescent, 8-12-seeded, 8.5-13 cm long. Seeds oblong, shining black.

Type : *Willdenow* 13399 (B—holotype).

Fls. : Sept.-Oct. *Frts.* : Nov.

Ecology : A species of rainforests.

Distribution : INDIA : Tropical Eastern Himalayas and Western Ghats, Bihar, West Bengal, Assam, Orissa, Karnataka, Tamil Nadu, Kerala, and Andaman Islands ; BURMA, NEPAL, PHILIPPINES, CHINA, THAILAND, TAIWAN, KAMPUCHEA (CAMBODIA), VIETNAM.

Uses : Seeds are often used as a pulse.

Notes : A remarkable species and perhaps form a connecting link between *Dolichos* and *Vigna*. It is distinguishable from all other species by the nature of keel and the distinctive tuft of hairs below the stigma on the style.

Maréchal (Bull. Jard. Bot. Natl. Belgique 47 : 483. 1977) transferred this taxon to *Dysolobium*, and made a new combination *D. pilosum* (Willd.) Maréchal. The same concept was adopted by Maréchal *et al.* (Boissiera 28 : 239. 1978). Because of the remarkable difference in the nature of pod between *V. pilosa* and species of *Dysolobium*, it is retained within the genus *Vigna*.

16. V. prainiana Babu et Sharma, *nom. nov. Phaseolus calcaratus* Roxb. var. *gracilis* Prain J. Asiat. Soc. Beng. 66 : 250. 1897 *non Vigna gracilis* (Guill. et Perr.) Hook. f. 1849.

Erect, nearly glabrous, annual herbs, with slender branches and graceful foliage. Leaflets ovate-lanceolate, sharply acute, nearly entire, pale-green, 2-5 × 2-3 cm. Petiole 2-4 cm long. Stipules lanceolate. Racemes short-peduncled, 2-5-tubercled. Flowers less than 1 cm long, yellow. Pods terete, glabrous, 4-5 cm long.

Lectotype : Malaya Peninsula : Perak, *Kunstler* 990 (K).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : It is common as an undergrowth of coniferous forests.

Distribution : INDIA : Himalayas (up to 3000 m), Uttar Pradesh, Sikkim ; MALAYSIA, CHINA, KAMPUCHEA (CAMBODIA), THAILAND, VIETNAM.

Notes : Closely allied to *V. calcarata,* but differs from it by its graceful habit with glabrous herbage, and smaller, narrower leaflets. This distinct species is also closely allied to *V. umbellata,* but it is remarkably different from it in floral characters as well as in the nature of pods. However, Maréchal *et al.* treated it as a variety of *V. umbellata* (Taxon 27 : 201. 1978 et in Boissiera 28 : 215. 1978).

17. Vigna radiata (L.) Wilczek in Fl. Congo Belge et Ruanda-Urundi, 6 : 386. 1954 ; Tourneur in Riz et Rizicult 5 : 131-148. 1958 *pro parte* ; Verdc. in Kew Bull. 24 : 558. 1970 (excl. vars. *sublobata* and *glabra*) ; Watt & Maréchal in Trop. Grain Leg. Bull. 7 : 31-33. 1977 ; Maréchal in Boissiera 28 : 209. 1978 ; Kay, Food Legum. 293. 1979. *Phaseolus radiatus* L. Sp. Pl. 725. 1753 ; Prain in J. Asiat. Soc. Beng. 66 : 428. 1897 ; Westphal in Cent. Agric. Publ. Doc. Agric. Res. Rep. 815. 1974. *P. aureus* Roxb. Fl. Ind. (ed. Carey) 3 : 297. 1832 (*non* Zuccagni, 1806).

Mung bean, Green gram, Golden gram (Eng.) ; *Dord, Mung, Moong, Pessara* (Hindi) ; *Sonamung* (Beng.) ; *Mag.* (Guj.) ; *Hesaru* (Kan.) ; *Cerupayaru* (Mal.) ; *Mug* (Mar.) ; *Pachapayru* (Tam.) ; *Patchapessalu, Pesalu* (Tel.).

Annual, much-branched, erect herbs, 30-50 cm tall. Stems, petioles and peduncles finely clothed with reflexed, brown or greyish-brown hairs. Leaflets ovate, acute-acuminate at apex, rounded-cuneate or truncate at base, often faintly 3-lobed at base, 6-10 (-12) × 6-10 cm. Stipels linear-lanceolate, 0.5-0.6 cm long. Petiole 4-5 cm long. Stipules broadly ovate-suborbicular to rounded, peltate, hairy, 0.5-0.7 × 0.3-0.5 cm. Racemes capitate on 1.5-4 cm long peduncles, 4-8-flowered. Flowers shortly pedicellate, 1-1.5 cm long. Bracteoles lanceolate, acuminate, 0.4 × 0.1 cm. Calyx up to 3 cm long. Corolla yellow. Pods turgid, erecto-patent or patent, minutely, appressedly bristly-hairy, 5-8 (-10) × 0.45-0.5 cm. Seeds 10-15 per pod, green or yellow, 0.4 (0.5) × 0.25-0.3 cm.

Lectotype : *Dillenius* plate Hort. Elth. 315. t. 235. f. 304.

Fls. : Aug.-Sept., Jan.-Feb. *Frts.* : Oct.-Nov., March-April.

Chr. No. : 2n=22, 23, 24, 44 (Sarbhoy in *Cytologia* 42 : 401-413. 1977 ; Raghuvanshi, Pathak and Singh in *Cytologia* 43 : 151. 1978 ; Rau in *Cytologia* 25 : 195-207. 1929 ; Krishnan and De in *Nucleus* 11 : 155-159. 1968).

Distribution: Cultivated throughout India (up to 2000 m in Himalayas). THROUGHOUT TROPICS.

Uses : One of the chief pulse crops of tropics, particularly of India. The protein-rich seeds constitute nutritious diet for vegetarians, in the form of dhal. It is also used in various fried and spiced dishes such as noodles and balls.

After removing the seed-coat and parching, mung beans may be ground into a nutritious flour or used as a source of starch. The flour is widely used as an ingredient for various bakery products and snack foods.

The green gram is frequently used for feeding children, invalids or geriatrics. Bean sprouts are widely used as a nutritious vegetable, particularly in S.E. Asia and E. Africa. The dry seed is sometimes used for animal feeding, particularly poultry. The green immature seed-pods are occasionally pickled and eaten as a vegetable.

The mung bean is also grown as a fodder, green manure and catch crops.

Notes : Often confused nomenclaturally and taxonomically with *V. mungo.* Recent genetical studies clearly suggest that it is a good species, and can be readily distinguished by its erect habit, sparsely setosely

hairy pods and green seeds. Prain (*loc. cit.*) recognized several land races as distinct varieties—*radiata*, *aurea* (=*Phaseolus aureus*) and *grandis* (=*P. max sensu* Roxb.). *P. torosus* Roxb. is also identical to *V. radiata.*

Mung bean is probably evolved in India. In Northern India it is grown as a monsoon crop, whereas in Southern, Western and Eastern India it is cultivated both during monsoon and cold seasons. In India cultivars suitable for growing in plains of Northern India during summer have been evolved. Recently a number of high-yielding varieties have been released. Some of them are Pusa Baisakhi, Krishna-11, Mung H 70-16, Koparyaon which are short-duration types suitable for multiple cropping programmes ; Jawahar-45 which is suitable for rainy season planting and for double cropping in rain-fed and limited water supply areas.

Recently, a high-yielding, quick-maturing, non-shattering cultivar has been developed in USA. It produces semi-glossy, large seeds, particularly suitable for the production of bean sprouts.

18. Vigna ricciardiana (Tenore) Babu et Sharma, *comb. nov. Phaseolus ricciardianus* Tenore, Ind. Sem. Hort. Neap. 4. 1833 ; Savi in Mem. Acc. Torin 38 : 173. t. 3. 1835 ; Prain in J. Asiat. Soc. Beng. 66 : 425. 1897. *P. pubescens* Bl. Cat. Gew. Buitenz. 93. 1823 *non Vigna pubescens* Wilczek 1954 ; Ohashi in Fl. East. Himal. 161. 1966. *V. umbellata sensu* Verdc. in Kew Bull. 24 : 560. 1970 *pro parte* : *sensu* Maréchal *et al.* in Boissiera 28 : 214. 1978 *pro parte.*

Annual, herbaceous twiners. Stems, petioles and peduncles clothed with long, grey hairs. Leaflets broadly ovate-lanceolate, entire or faintly lobed at base, 5-12 × 2-8 cm. Petiole 2-20 cm long. Stipules peltate, broadly lanceolate, 1-2 × 0.3-0.5 cm. Racemes elongated, often paniculate, many-tubercled, long-peduncled. Flowers yellowish, on 0.3-0.4 cm long pedicels, 1.5-2.5 cm long. Bracteoles as long as or longer than calyx. Calyx 0.35-0.45 cm long. Pods deflexed, falcate, compressed, 6-9 cm long. Seeds green, yellow, red, brown or black.

Type : Hort. Neapal. *Tenore, s. n.* (K-holotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Chr. No. : 2n=22 (Sarbhoy in *Taxon* 27 : 53-61. 1978).

Distribution : INDIA : Cultivated in hilly tracts of Central and Eastern India, Bihar, Orissa, Assam, N.E. India, Madhya Pradesh.

Uses : Young pods are used as a vegetable. Beans are used as a pulse.

Notes : A remarkable, unexploited legume of potential value. It is known only in tribal belts. It is often considered as conspecific with *V. umbellata* and *V. calcarata. V. ricciardiana* differs from both *V. umbellata* and *V. calcarata* by paniculate, many-tubercled racemes, compressed, somewhat fleshy, reflexed pods, and large flowers.

Critical examination of the types of *P. pubescens* Bl. and *P. ricciardiana* confirm their conspecificity.

19. V. sublobata (Roxb.) Babu et Sharma, *comb. nov. Phaseolus sublobatus* Roxb. Fl. Ind. (ed Carey) 3 : 288. 1832 ; Prain in J. Asiat. Soc. Beng. 66 : 423. 1897 ; Gamble, Fl. Pres. Madr. 1 : 363. 1918 (Repr. ed. 1 : 255. 1957) ; Cooke, Fl. Pres. Bomb. 1 : 377. 1903 (Repr. ed. 1 : 402. 1958) ; Haines, Bot. Bih. Or. 1 : 288. 1925 (Repr. ed. 1 : 301. 1961). *P. setulosus* Dalz. in Hook. J. Bot. 2 : 33. 1850. *P. sublobatus* Roxb. var. *setulosus* (Dalz.) Prain in J. Asiat. Soc. Beng. 66 : 423. 1897. *Vigna radiata* Wilczek var. *setulosa* (Dalz.) Ohwi & Ohashi in Jap. J. Bot. 44 : 31. 1969 ; Maréchal *et al.* in Boissiera 28 : 211. 1978. *Phaseolus sublobatus*

Roxb. var. *grandiflora* Prain in J. Asiat. Soc. Beng. 66 : 423. 1897. *P. trinervius* Wt. et Arn. Prodr. 245. 1834 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 203. 1876. *V. brachycarpa* Kurz in J. Asiat. Soc. Beng. 43 : 185. 1874 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 206. 1876. *V. radiata* (L.) Wilczek var. *sublobata* (Roxb.) Verdc. in Kew Bull. 24 : 559. 1970 ; Watt & Maréchal in Trop. Grain Leg. Bull. 7 : 31-33. 1977. Maréchal *et al.* in Boissiera 28 : 210. 1978. *Phaseolus radiatus auctt. mult.* (*non L. sensu stricto*) : Piper in U.S. Dept. Agric. Bull. 119 : 16. 1914 ; Leese in Amer. Midl. Nat. 60 : 143. 1958.

Ghora Mung (Beng.).

Annual, subscandent or twining, sparsely to much-branched herbs with erect to erecto-patent or decumbent-ascending branches of 10-50 cm long. Stems, petioles and peduncles clothed with ferrugineous, deflexed hairs. Leaflets ovate-deltoid, with acuminate apex and subcuneate-subtruncate base, ciliate. Stipels linear, 0.3-0.4 cm long. Stipules falcate-lanceolate or rarely ovate-oblong, 0.5-0.8 × 0.3-0.4 cm. Racemes capitate, on long peduncles, 2-6-flowered. Flowers yellowish, up to 1 cm long. Calyx-lobes ovate-triangular, thinly hairy, 0.2 cm long. Pods subcompressed, clothed with ferrugineous hairs, 2.5-5 cm long. Seeds 4-10 per pod, brown or greyish-brown, 0.25-0.3 × 0.2-0.25 cm.

Lectotype : Roxburgh's Icones (ined.) 1158 (CAL).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Ecology : A species of forest margins and grasslands.

Chr. No. : 2n=22 (Gopinathan and Babu in *Cytologia* 1985).

Distribution : INDIA : Hilly tracts of Western, Central and Eastern India ; Assam, West Bengal, Bihar, Orissa, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, Kerala ; MALAYSIA ; THROUGHOUT TROPICS.

Uses : Seeds are used as a pulse at the time of scarcity. Livestock grazes on this plant which is the component of grasslands in Western Ghats.

It may be used as fodder, soil conservation and cover crops.

Notes : Highly variable in habit, intensity of indumentum, size and shape of leaflets, length and hairiness of pods and seed number and size. Population biological studies reveal that *V. sublobata* comprises well-differentiated, locally adapted gene pools which are of immense value in broadening the genetic base of cultivated species such as *V. mungo* and *V. radiata.* Biochemical studies of populations by the authors also revealed cryptic genetic variability, and there is a substantial variability in seed protein content and amino acid composition of seed proteins.

Genetical and biochemical studies of populations inhabiting different ecogeographical zones conclusively prove that it is the putative progenitor of *V. mungo*, and is remotely related to *V radiata.* Some taxonomists (Piper, *loc. cit.*) have been treating *V sublobata* as conspecific with *V. mungo*, and a few authors (Verdcourt, *loc. cit.*) as a variety of *V. radiata.* Since *V sublobata* is morphologically distinguishable from both *V. radiata* and *V. mungo*, it is justified to treat it as a distinct species, as has been done by Prain (*loc. cit.*) under *Phaseolus.* Further the F_1 interspecific hybrids between *V. mungo* and *V sublobata* and *V. radiata* and *V. sublobata* are sterile. This also proves the existence of sterility barriers among these three species.

Prain (*loc. cit.*) recognized two varieties-*setulosa* which is characterised by small flowers and greyish indumentum of stems and pods ; and *grandiflora* which has large flowers and reddish or ferrugineous-brown

indumentum of stems and peduncles. These varieties represent some of the locally adapted, well-differentiated populations, and do not deserve any taxonomic status.

20. Vigna trilobata (L.) Verdc. in Taxon 17 : 172. 1968 et in Kew Bull. 24 : 560. 1970. *Dolichos trilobatus* L. Mant. 1 : 101. 1767. *Phaseolus trilobatus* (L.) Schreb. in Nov. Acta Acad. Caes. Leop. Carol. Nat. Curios. 4 : 133. 1770. *P. trilobus sensu* Ait. et *auctt. mult.* (*non Dolichos trilobus* L.) : Baker in Hook. f. Fl. Brit. Ind. 2 : 201. 1876 ; Gamble, Fl. Pres. Madr. 1 : 362. 1918. (Repr. ed. 1 : 255-256. 1957) ; Cooke, Fl. Pres. Bomb. 1 : 376. 1903 (Repr. ed. 1 : 401. 1958) ; Duthie, Fl. Upp. Gang. Pl. 1 : 224. 1903 (Repr. ed. 1 : 224. 1973) ; Haines Bot. Bih. Or. 1 : 287. 1925 (Repr. ed. 1 : 301. 1961).

Mugani, Trianguli, Rakhalkaldi (Hindi) ; *Mugan* (Beng.) ; *Ceruvidukol* (Mal.) ; *Pani payir* (Tam.) ; *Pilli Pesara* (Tel.).

Trailing or twining, straggling or suberect, annual-perennial herbs. Stems often prostrate below, ascending upwards, glabrescent. Leaflets highly variable in shape, size and lobation, lateral ones unequal and cuneate at base, all leaflets palmately 3-lobed to-partite. Petiole 4-12 cm long. Stipules highly variable in size, peltate, broadly ovate-oblong, with a cordate or subtruncate base, ciliate, 1.5 × 1 cm. Racemes capitate, on 20-30 cm long peduncles. Flowers on 0.2 cm long pedicels. Bracts obovate, 0.2 cm long. Bracteoles lanceolate. Calyx 0.3 cm long. Corolla 1 cm long. Pods terete, patent, 6-16-seeded, glabrous or minutely, setosely hairy. Seeds black or greenish, 0.2 × 0.2 cm.

Lectotype : India : *Plukenet's* Alm. Bot. 292. Phytogr. t. 120. f. 3.

Fls. : Sept.-Nov. *Frts.* : Oct.-Dec.

Ecology : Wild along the bunds of rice fields and other agricultural lands.

Chr. No. : 2n=22, 44 (Joseph and Bouco-kamp in *Cytologia* 43 : 595-600. 1978).

Distribution : INDIA : Cultivated and wild throughout India (from sea coast to 3000 m in Himalayas) ; tropics.

Uses : Seeds are used as a pulse. It is widely grown for fodder. It is sometimes cultivated as a green manure and soil conservation crop. It may be used for controlling soil erosion.

Notes : The agricultural populations differ from wild ones in erect, robust habit, large foliaceous stipules, large, fleshy leaflets and glabrous herbage. The wild forms are decumbent-ascending, perennial herbs with hairy foliage and small stipules and leaflets. Populations inhabiting coastal tracts have thick, fleshy leaflets which are nearly entire. *V. trilobata* is probably evolved from India.

21. V. umbellatta (Thunb.) Ohwi et Ohashi in J. Jap. Bot. 44 : 31. 1969 ; Verdc. in Kew Bull. 24 : 560. 1970 ; Maréchal *et al.* in Boissiera 28 : 214. 1978. *Dolichos umbellatus* Thunb. in Trans. Linn. Soc. 2 : 339. 1794. *Phaseolus calcaratus* Roxb. Fl. Ind. (ed. Carey) 3 : 289. 1832 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 203. 1876. *V. calcarata* (Roxb.) Kurz in J. Asiat. Soc. Beng. 45 : 247. 1876.

Rice bean (Eng.) ; *Ghurush, Gurounsh, Gurush, Pau maia, Shiltong, Sita-mas, Sutari* (Hindi).

Twining or suberect herbs. Stems densely pubescent when young, glabrescent on maturity. Leaflets ovate-deltoid, subcuneate-subtruncate at base, acuminate at apex, entire to shallowly lobed at base, up to 12 cm long. Stipules ovate-lanceolate, 0.7-1.0 × 0.4 cm. Racemes long, lax, many-tubercled, 5-7.5 cm long (incl. peduncle). Flowers on 0.2-0.4 cm long pedicels. Bracteoles 0.3 cm long. Corolla yellow, up to 2 cm long. Pods compressed, slightly recurved, reflexed, glabrous,

3.5-9 × 0.3-0.5 cm. Seeds 4-12 per pod, green, yellow, brown, maroon, black, mottled or straw-coloured, 0.8 × 0.4 cm.

Type : *Thunberg* 16789 (UPS—holotype).

Fls. : Aug.-Sept. *Frts.* : Oct.-Nov.

Chr. No. : 2n=22, 44 (Joseph and Bouwkamp in *Cytologia* 25. 195-207. 1978).

Distribution : INDIA : Cultivated in the plains of Northern India and in Himalayas (up to 3000 m) ; Uttar Pradesh, Himachal Pradesh, Assam, Sikkim, West Bengal ; cultivated in tropics.

Uses : The rice bean is a nutritious pulse crop. The beans are often cooked with or instead of, rice, often in soups and stews. The seeds are sometimes used as a livestock food.

The green immature seed pods and young leaves are used as a vegetable. The rice bean is often cultivated as a fodder or green manure crop. It is also grown as a cover crop.

Notes : *V. umbellata* is an unexploited legume of potential value. It is probably evolved in Asia. It is often confused with *V. riccicardiana* and *V. angularis.* The characteristic features of rice bean are reflexed pods which are compressed, and large, speckled seeds. The different cultivars and land races differ in habit, density of indumentum, and size and colour of seeds. var. *rumbaiya* Prain is one land race with erect habit and shorter stems ; var. *glaber* has smooth stems and leaves ; and var. *major* has larger flowers.

22. Vigna unguiculata (L.) Walp. Rep. 1 : 779. 1842 ; Piper in U. S. Dept. Agric. Bur. Pl. Ind. Bull. No. 229. 1912 et in U. S. Dept. Agric. Bur. Pl. Ind. Circ. 124 : 29. 1913 ; Wilczek in Fl. Congo-Belge et Ruanda-Urundi 6 : 387. t. 30. 1954 ; Verdc. in Kew Bull. 24 : 542. 1970 ; Westphal in Cent. Agric. Publ. Doc. Agric. Res. Resp. 815. 1974 ; Maréchal *et al.* in Boissiera 28 : 191. 1978. Kay, Food Leg. 86. 1979. *Dolichos unguiculatus* L. Sp. Pl. 725. 1753.

Cow pea, Black eye bean or *pea, Catjang, China pea, Cow gram, Southern pea* (Eng.) ; *Lobia* (Hindi) ; *Urohi, Urhi mah* (Asm.) ; *Barabati* (Beng.) ; *Chorap* (Guj.) ; *Tadagunny* (Kan.) ; *Chaoli, Chaula, Chavli, Chowlee, Chowli* (Mar.) ; *Kotta Payuru* (Mal.) ; *Dirghabija* (Sans.) ; *Thatta payru, Karmani* (Tam.) ; *Bobberulu, Alasendi* (Tel.) ; *Indian pea* (USA).

Erect or scandent or straggling or trailing or twining herbs. Stems, petioles and peduncles glabrous or often covered with scattered tubercles. Leaflets ovate-rhomboid-oblong, 7-16 × 4-11 cm, lateral ones often oblique at base. Stipules 1-2 cm long. Racemes capitate, 3-8-tubercled, on 2-30 cm long peduncles. Flowers greenish-yellow, on 0.1-0.3 cm long pedicels. Bracteoles fugacious. Calyx longitudinally ribbed, transversely plicate-tuberculate, 0.5-0.6 cm long, lobes acuminate. Standard 2-3 cm across, greenish on the back at first, afterwards yellowish, on the inside mostly bluish-violet, sometimes sordidly yellow. Pods subterete, 6-8.5 × 0.5-1.1 cm. Seeds 9-30 per pod, black, red, yellow or white.

Type : *Linnaeus* 900.5 (LINN—holotype).

Fls. : Sept.-Oct., Jan.-Feb. *Frts.* : Oct.-Nov., March-April.

Distribution : Cultivated throughout India (up to 3000 m in Himalayas) ; widely grown in tropics ; probably originated in Africa.

Uses : The dried seeds are an important food legume crop in tropics and subtropics providing an inexpensive source of protein. The beans are used as a pulse. The green pods are harvested for use as a vegetable and the residual plant material is used for feeding livestock. In USA some cultivars, such as Black-eye, Crowder and Purple-eye, are grown for canning. In Africa, the beans

are consumed in different forms : (i) they are cooked together with vegetables, spices and often palm oil, to produce a thick bean soup, which accompanies the basic staple food, such as cassava, yams, plantains, etc., and (ii) they are also decorticated, ground into a flour and mixed with chopped onion and spices and made into cakes, which are either deep fried (akara balls) or steamed (moin-moin).

The young shoots are frequently boiled and eaten as spinach. In some areas, the mature leaves are dried in sun after boiling before being stored for use when fresh vegetables are scarce.

Cowpeas are sometimes grown for green manure, as a cover crop for anti-erosion or for the production of hay.

Notes : Verdcourt (*loc.cit.*) recognized five subspecies—*dekindtiana, sesquipedalis, unguiculata, cylindrica* and *mensensis* of which three are recorded for India.

1a. Pods 0.3-0.9 m long. Plants mostly twining .. subsp. *sesquipedalis*
1b. Pods not more than 30 cm long. Plants erect or twining :
  2a. Pods 20-30 cm long. Plants twining or sometimes erect .. subsp. *unguiculata*
  2b. Pods 7.5-13 cm long. Plants frequently suberect, but sometimes twining .. subsp. *cylindrica*

subsp. **cylindrica** (L.) van Eseltine in Hedricks, Veget. New York 1 (2) : 11. 1931 ; Verdc. in Kew Bull. 24 : 544. 1970. *Phaseolus cylindricus* L. Herb. Amb. 23. 1754 et Amoen Acad. 4 : 132. 1759. *Dolichos catjang* Burm. f. Fl. Ind. 161. 1768. *Vigna catjang* (Burm. f.) Walp. in Linnaea 13 : 533. 1839. *V. sinensis* (L.) Hassk. var. *catjang* (Burm. f.) Chiov. in Ann. Ist. Bot. Roma 8 : 438. 1908. *V. cylindrica* (L.) Skeels in U. S. Dept. Agric. Bur. Pl. Ind. Bull. 282 : 32. 1913. *V unguiculata* (L.) Walp. subsp. *catjang* (Burm. f.) Chiov. Raccolte. Bot. Miss. Cons. Kenya 35. 1935.

Suberect herbs. Leaflets ovate-deltoid, shortly acuminate, faintly lobed at base, 10-18 × 3-5 cm, lateral ones deltoid-subtruncate at base ; terminal one cuneate at base. Petiole 4-12 cm long. Stipules ovate-lanceolate, acuminate, 1.4 × 0.3-0.4 cm. Racemes capitate, 4-6 (-10)-tubercled, on 3-18 cm long peduncle. Flowers on 0.2 cm long pedicels. Calyx campanulate ; segments 0.2 cm long. Pods patent, 10-15-seeded, shortly beaked, 10-15 cm long. Seeds brown or white, 6.5 × 0.45 cm.

Type : Herb. *A. van Royen* (L—holotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Chr. No. : 2n=22, 33, 44, 66 (Datta and Saha in *Bull. Bot. Soc. Beng.* 27 : 71-76. 1973).

Distribution : Cultivated throughout India (up to 2000 m in Himalayas) ; ARABIA, VIETNAM.

Notes : The cultivars of this species are referred as catjang cowpea. Maréchal *et al.* (*loc. cit.*) treated this as cultivar-group (cv. gr.) Biflora, following Westphal (*loc. cit.*). *Dolichos biflorus* L. (Sp. Pl. ed. 1. 727. 1753) is conspecific with *Phaseolus cylindricus* L. (*see* Maréchal *et al. loc. cit.*).

subsp. **sesquipedalis** (L.) Verdc. in Davies, Fl. Turkey 3 : 266. 1970 et in Kew Bull. 24 : 544. 1970. *Dolichos sesquipedalis* L. Sp. Pl. ed. 2. 1019. 1763. *V. sinensis* (L.) Savi ex Hassk. var. *sesquipedalis* (L.) Ascherson et Schweinf. Ill. Fl. Egypt. in Mem. Inst. Egypt. 2 : 1889. *V. sesquipedalis* (L.) Fruhw. Anbau Hulsenfr. 254. 1898. *V. sinensis* (L.) Savi ex Hassk. subsp. *sesquipedalis* (L.) van Eseltine in Hedrick, Veget. New York 1 (2) : 11. 1931 ; Mansf. Prodr. Enum. Sp. Pl. Agri.-Hort. 210. 1959.

Twining herbs. Leaflets rhomboid-ovate-deltoid, 7-14 cm long. Stipules broadly lanceolate, 1.2-1.5 × 0.4-0.5 cm. Racemes

capitate, few-tubercled. Flowers 1.9-2.5 cm long, violet. Pods pendent, thick, fleshy, slightly compressed, brittle, flabby, shrinking between seeds before drying, 30-90 cm long. Seeds 10-15 per pod, 0.8-1.3 × 0.7-0.8 cm.

Neotype : Ethiopia : *Westphal* 8677 (WAG).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Distribution : INDIA : Cultivated in hilly tracts ; Madhya Pradesh, Bihar, Orissa, Assam ; N.E. India.

Notes : The cultivars of this subspecies are collectively known as yard long-bean. Maréchal *et al.* (*loc. cit.*) treated this as a cv.-gr. Sesquipedalis, following Westphal (*loc. cit.*).

subsp. **unguiculata** Verdc. in Kew Bull. 24 : 543. 1970. *Dolichos unguiculatus* L. Sp. Pl. 725. 1753. *D. sinensis* L. Herb. Amb. 23. 1754, Cent. Pl. 2 : 28. 1756 et Amoen. Acad. 4 : 132, 326. 1759. *Vigna sinensis* (L.) Savi ex Hassk. Cat. Pl. Hort. Bogor 279. 1844. *V. sinensis* (L.) Savi ex Hassk. subsp. *sinensis* ; Mansf. Prodr. Enum. Sp. Pl. Agri-Hort. 209. 1959.

Characters are similar to the typical species.

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Chr. No. : 2n=22, 24 (Maréchal in *Bull. Jard. Bot. Nat. Belg.* 40 : 307-348. 1970 ; Floresca, Capinpin and Pancho in Philip. Agric. 44 : 290-298. 1960).

Distribution : INDIA : Cultivated throughout India (up to 3000 m in Himalayas).

Besides the three subspecies cultivated in India, Verdcourt (*loc. cit.*) recognized subsp. *dekindtiana* (Harms) Verdc. (=*V. dekindtiana* Harms) for wild populations found in Africa, and subsp. *mensensis* (Schweinf.) Verdc. (=*V. mensensis* Schweinf.) which is also wild in Africa. The latter is distinguished from all other species by the calyx-lobes being shorter than the tube (0.5-1.4 cm long), whereas the former is recognizable by pods being 5.5-10 × 0.3-0.5 cm, scabrous and shattering, and calyx-lobes being shorter than the tube (0.25-0.5 cm long). All the three cultivated subspecies are characterised by calyx lobes shorter than the tube. Maréchal *et al.* (in Taxon 27 : 200. 1978. et in Boissiera 28 : 194. 1978) treated subsp. *mensensis* as a variety under subsp. *dekindtiana*. They also recognized varieties *pubescens* and *protracta* under the same subspecies. Besides subspecies *unguiculata, dekindtiana*, they also established subsp. *tenuis* and subsp. *stenophylla* within the species *V. unguiculata.*

23. Vigna vexillata (L.) A. Rich. Hist. Fis. polit. nat. 1. Cuba (Spanish ed.) 11 : 191. 1845 et Ess. Fl. Cuba : 440. 1846 ; Baker in Hook. f. Fl. Brit. Ind. 2 : 206. 1876 *pro parte* ; Gamble, Fl. Pres. Madr. 1 : 364. 1918 (Repr. ed. 1 : 257. 1957) ; Haines, Bot. Bih. Or. 1 : 290. 1925 (Repr. ed. 1 : 303. 1961) ; Verdc. in Kew Bull. 24 : 553. 1970 ; Maréchal *et al.* in Boissiera 28 : 202. 1978. *Phaseolus vexillatus* L. Sp. Pl. 729. 1753.

Jermei-soh-lang-tor (Khasi).

Twining or straggling, perennial herbs, with a tuberous rootstock. Stems, petioles and peduncles glabrescent to hirsutely hairy with short hairs. Lateral leaflets obliquely ovate-deltoid, terminal one ovate-rhomboid ; all leaflets acuminate and shortly mucronate, subcuneate at base, appressedly hairy, ciliate, 4-15 × 2.5-5 cm. Petiole 4-6 cm long. Stipules small, linear-filiform. Racemes on 6-10 cm long peduncles, capitate, 2-4-flowered. Flowers light purple, up to 3 cm long. Bracteoles linear, 0.7-0.8 cm long. Calyx campanulate, glabrescent-hairy, 1-1.5 cm long, lobes linear, 0.5-0.6 cm long, ciliate. Corolla 2-2.5 cm long ; standard light violet on the innerside, yellowish on the outside,

with two well-developed auricles. Pods sub-compressed, slightly curved, glabrescent to hirsutely hairy with reddish-brown hairs, 7-12 cm long. Seeds 8-15 per pod, brown.

Type : Cuba (Havana) : *Linn. Herb. s. n.* (UPS—holotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Dec.

Distribution : INDIA : Hilly tracts of Peninsular, Central and Eastern India and Himalayas (up to 2000 m). Cosmopolitan in tropics, AUSTRALIA.

Chr. No. : 2n=22, 24 (Maréchal in Bull. Jard. Bot. Nat. Belg. 40 : 307-348. 1970 ; Frahm-Leliveld in Euphytica 14 : 251-270.

Uses : Not recorded. It may be useful to grow as a soil conservation and cover crop. It can be grown for controlling soil erosion.

Notes : Highly variable with respect to indumentum, shape and size of leaflets, flower size and length, and hairiness of pods. Based on the variability patterns in these characters, five varieties are recognized —*vexillata, angustifolia, sepiaria, stocksii* and *wightii.*

1a. Leaf narrowly lanceolate, 2-2.5 cm broad .. var. *angustifolia*
1b. Leaflets ovate-deltoid, more than 3 cm broad :
  2a. Leaflets membranous, glabrescent. Stems, petioles and peduncles sparsely covered with short, brown hairs .. var. *sepiaria*
  2b. Leaflets coriaceous, pubescent with rusty-brown hairs. Stems, petioles and peduncles densely covered with long, rusty brown hairs :
    3a. Calyx densely villous with short, rusty brown hairs. Leaflets subobtuse, mucronate .. var. *wightii*
    3b. Calyx hirsute with long, rusty-brown hairs. Leaflets acuminate :
      4a. Leaflets 4-15 cm long. Flowers 2.5 cm long. Calyx lobes up to 2 cm long .. var. *vexillata*
      4b. Leaflets less than 6 cm long. Flowers 2 cm long. Calyx lobes up to 1 cm long .. var. *stocksii*

var. **vexillata** ; Verdc. in Kew Bull. 24 : 554. 1970 *pro parte* ; Maréchal *et al.* in Boissiera 28 : 202. 1978. *Strophostyles capensis* (Thunb.) E. Mey. Comm. Pl. Afr. Austr. 147. 1836 (*non Phaseolus capensis* Thunb. 1800, *sensu stricto*).

Characters of the typical species.

var. **angustifolia** (Schumach et Thonn.) Baker in Fl. Trop. Afr. 2 : 200. 1871 ; Verdc. in Kew Bull. 24 : 554. 1970 ; Maréchal *et al.* in Boissiera 28 : 204. 1978. *Plectrotropis angustifolia* Schumach et Thonn. Beskr. Guin. Pl. 338. 1827. *Phaseolus capensis* Thunb. Prodr. Fl. Cap. 130. 1800 (*non* Burm. f. 1768). *Vigna capensis* (Thunb.) Burtt Davy, Man. Fl. Pl. Transv. 2. 34 : 420. 1932 [*non V capensis* (L.) Walp.] *nom. illeg.*

Herbaceous, with prostrate branches. Stems, petioles and peduncles appressedly hairy with deflexed bristly hairs. Leaflets oblong-lanceolate, long-acuminate, subtruncate-rounded at base, 8-12 × 2-2.5 cm. Stipules small, linear, hairy. Petioles 3-4 cm long. Racemes 2-4-flowered, on 8-20 cm long peduncles. Calyx bristly hairy with rusty-brown hairs, 1.4 cm long, lobes 0.6-0.7 cm long. Corolla 2-2.5 cm long. Pods patent, covered with short, brown hairs when young.

Type : Ghana : Puilta, *Thonning, s. n.* (C—holotype).

Fls. : Sept.-Oct. *Frts.* : Nov.-Dec.

Distribution : INDIA : Tropical Himalayas and hilly tracts of central, eastern and southern India ; Himachal Pradesh, Uttar Pradesh, Bihar, Assam, Sikkim, Orissa, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, Kerala ; NEPAL, BHUTAN, AFRICA, AUSTRALIA, VIETNAM, KAMPUCHEA.

var. **sepiaria** (Dalz.) Babu et Sharma, *comb. nov. Phaseolus sepiarius* Dalz. in Hook. Kew J. 2 : 33. 1850 ; *V. vexillata* (L.) A. Rich. var. *vexillata* ; Verdc. in Kew Bull.

24 : 554. 1970 *pro parte* ; Maréchal *et al.* in Boissiera 28 : 202. 1978.

Herbaceous twiners. Stems, petioles and peduncles glabrescent with very short, brown hairs. Leaflets broadly ovate-deltoid, entire, ciliate. Petiole 4-6 cm long. Stipules lanceolate, ciliate, 0.7 × 0.3 cm. Racemes on 3-15 cm long peduncles. Bracteoles 0.4 cm long. Calyx glabrescent to rusty brown-villous ; lobes 0.6-0.7 cm long. Corolla up to 2.5 cm long. Pods glabrescent to rusty brown-hairy, 15-20-seeded. Seeds black, shining, 0.4 × 0.3 cm.

Type : India : Bombay, *Dalzell, s. n.* (K—holotype).

Fls. : Sept.-Oct. *Frts.* : Oct.-Nov.

Distribution : India : Western Ghats, Maharashtra, Karnataka, Kerala, Tamil Nadu ; endemic.

var. **stocksii** Benth. ex Baker in Hook. f. Fl. Brit. Ind. 2 : 206. 1876. *Phaseolus pulniensis* Wt. Ic. 1 : t. 202. 1839. *Vigna hirta* Hook. Ic. Pl. t. 637. 1844. *V. vexillata* (L.) A. Rich. var. *vexillata* ; Verdc. in Kew Bull. 24 : 554. 1970 *pro parte* ; Maréchal *et al.* in Boissiera 28 : 202. 1978 *pro parte.*

Scandent or trailing herbs. Stems, petioles and peduncles clothed with long, deflexed, ferrugineous hairs. Leaflets ovate-elliptic, acute to shortly acuminate, ciliate, 4-5 × 2-3.5 cm. Petiole 3-8 cm long. Stipules ovate-lanceolate, ciliate. Peduncles of racemes up to 18 cm long. Bracteoles setaceous, up to 0.5 cm long. Calyx densely rusty brown-hairy, 1.5-1.8 cm long, lobes up to 1 cm long. Corolla up to 2 cm long. Pods densely rusty-pubescent when young. Seeds black, 15-20 per pod.

Type : India : Concan, *Stocks, s. n.* (K—holotype).

Distribution : India : Hilly tracts of Peninsular and Eastern India, Maharashtra, Karnataka, Tamil Nadu, Kerala, Madhya Pradesh, Bihar, Orissa ; endemic.

var. **wightii** (Benth. ex Baker) Babu et Sharma, *comb. nov. Vigna wightii* Benth. ex Baker in Hook. f. Fl. Brit. Ind. 2 : 206. 1876 ; Gamble, Fl. Pres. Madr. 1 : 365. 1918 (Repr ed. 1 : 257. 1957).

Type : India : *Wight* 1836 (K—holotype).

Fls. : Sept.-Oct. *Frts.* : Nov.-Dec.

Distribution : India : Western Ghats, Karnataka, Kerala, Tamil Nadu ; endemic.

Notes : Very similar to var. *sepiaria* in most of the characters, but var. *wightii* differs from the latter by coriaceous leaflets and short, more dense indumentum of herbage.

DOUBTFUL AND EXCLUDED SPECIES

Vigna repens Baker (in Hook. f. Fl. Brit. Ind. 2 : 205. 1876) (*non* Kuntze, 1891) was recorded from Burma. The type at Kew (Wallich 5608) is a poor specimen and shows large bracteoles. In all probability it belongs to *Vigna.* This species may extend into N-E India.

Phaseolus tenuicaulis Baker (in Hook. f. Fl. Brit. Ind. 2 : 201. 1876) was also recorded from Burma. It belongs to *Dolichos tenuicaulis* (Baker) Craib (Contrib. Fl. Siam. Dicot. 66 : 1912).

Voandzeia subterranea (L.) Thouars—a taxon often cultivated (cf. Fl. Brit. Ind. 2 : 205. 1876) in India—is often treated under *Vigna* (cf. Maréchal *et al.* in Boissiera 28 : 177. 1978).